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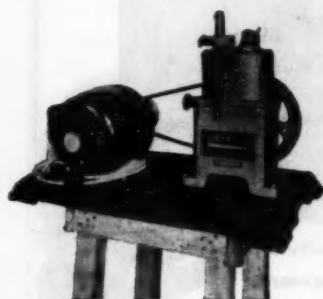
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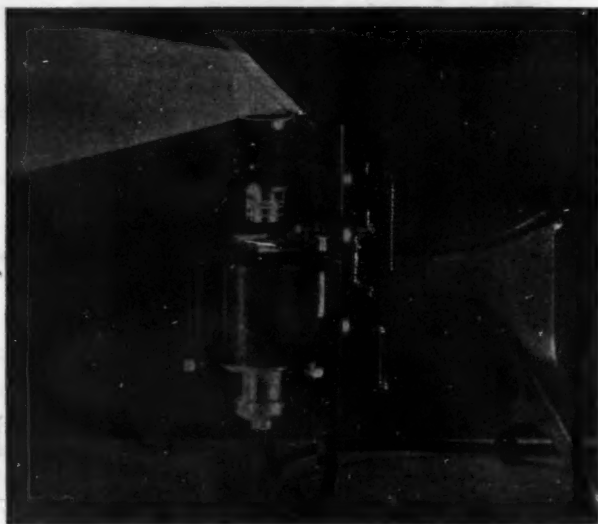
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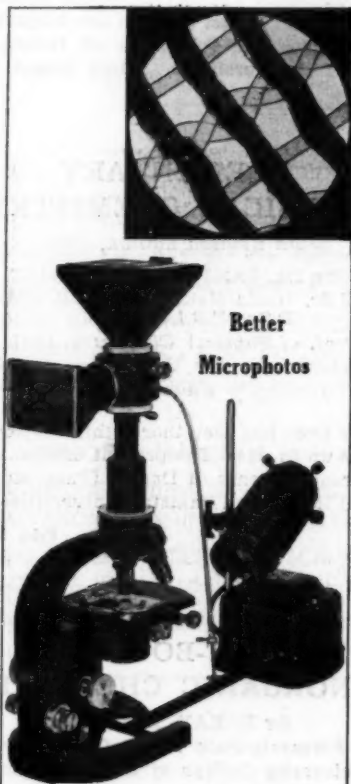
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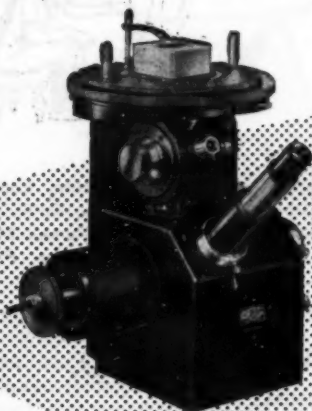
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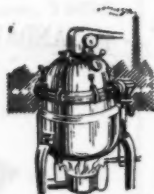
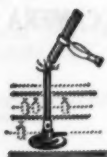
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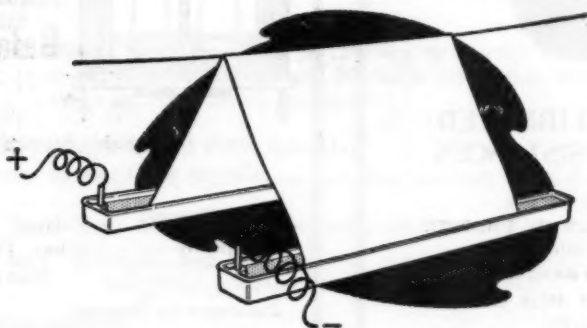
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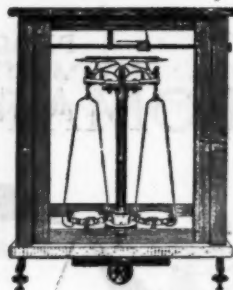


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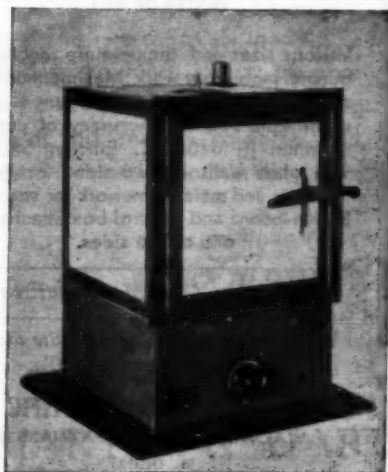
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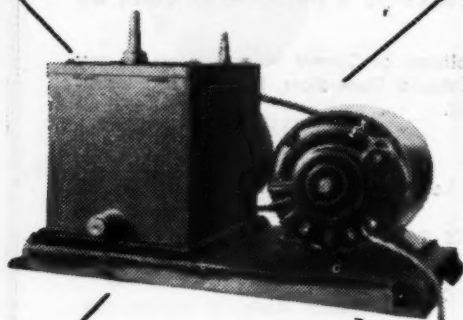
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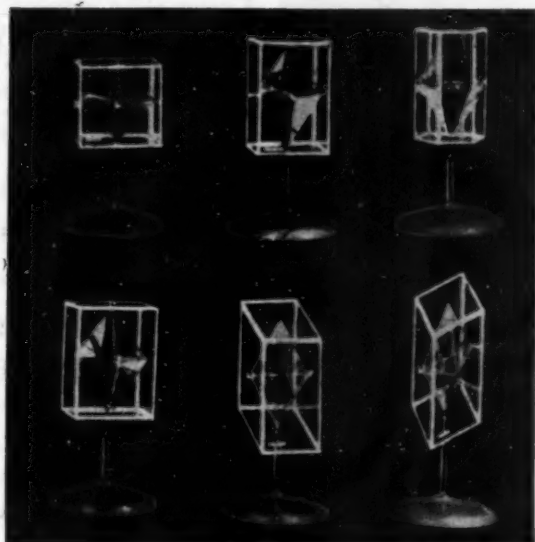
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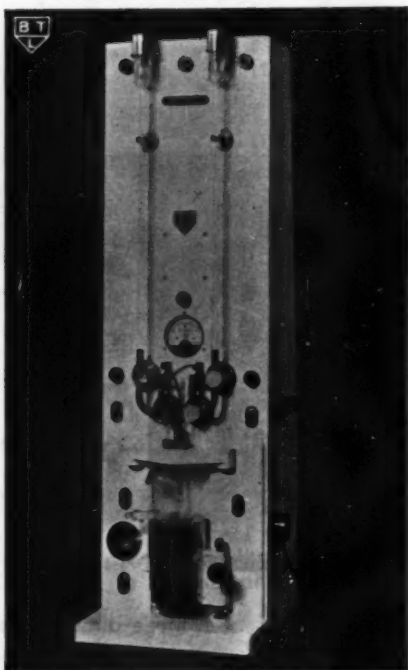
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## PROGRESS OF FISHERIES DEVELOPMENT IN INDIA

AS observed by Sri. A. P. Jain, Minister for Food and Agriculture, Government of India, in his message to the All-India Fisheries Exhibition\* organised recently in Cuttack, the development of fisheries is a problem of national importance, but unfortunately in the past fishery has not received the attention that it deserves. Since the planning began, more attention has been devoted to this important aspect of food problem and under the Second Plan, considerable provision is expected to be made for the development of fisheries and fishing craft on an organised and scientific basis.

The Union and the State Governments have been taking progressive measures for increasing fish production and developing the fishing industry in India, with a noticeable measure of success. With financial and technical assistance from the Centre, most of the States have been able to substantially increase their production by bringing under fish culture large

areas of inland waters and by extending and intensifying fishing operations in coastal waters.

The Central Marine Fisheries Research Station was established in 1947 to carry on research on problems of marine fisheries with a view to estimating the resources, the rate of present exploitation, the possibilities of increasing production and utilization and recommending measures of conservation, if necessary. The Station was originally started at Madras, but is now located at Mandapam in South India. The work of the Station is done at headquarters and at a number of Substations. The Substation at Bombay specialises in research on offshore fisheries, that at Karwar on mackerel fisheries, that at Calicut on fishery biology and on the oil sardine and mackerel fisheries, that at Cochin on prawn fisheries and that at Madras on molluscan fisheries. Biological and statistical data relating to fish landings are collected by trained survey assistants stationed in twelve different zones of the coast and are analysed at the headquarters. Studies on marine biology, hydrology, utilization of sea-weeds, marine fish farming and on certain small fisheries are also carried on at Mandapam. The Station is under

\* A Souvenir Volume published on the occasion contains 'authoritative' articles by specialists on various aspects of fisheries research and development in India.

the charge of a Chief Research Officer, who has a team of trained zoologists, botanists, chemists, bacteriologists and others to assist him.

Under the Second Five-Year Plan the Station will expand its activities relating to the studies on principal commercial fisheries (mackerel, sardines and prawns), offshore fisheries, marine biology with increased emphasis on its relation to pelagic fisheries, and effects of various kinds of fishing on fish stocks. Additional research substations will be established.

The Central Inland Fisheries Research Station was also established in 1947 and started its life at Calcutta. It was later shifted to Barrackpore, but, on account of some damage to its buildings there, has been temporarily brought back to Calcutta. The work of the Station is broadly divided into three main sections, viz., Estuarine, Pond Culture and Riverine and Lacustrine. The work of the Estuarine Section and that of training, along with certain other activities, is carried on at the headquarters, while that of the Pond Culture and the Riverine and Lacustrine Sections is done at the Substations at Cuttack and Allahabad respectively. This Station also is under the charge of a Chief Research Officer, who is assisted by a band of workers especially trained in different branches of fisheries research.

Under the Second Five-Year Plan it is proposed to intensify the existing programme of investigations with particular reference to estuarine fisheries, brackish water fish farming, fisheries in natural and artificial lakes, fisheries in the large river systems, fish cultural practices, effect of river pollutions on fisheries, and the control of weeds. Additional Substations are also expected to be established.

The Pilot Deep-Sea Fishing Station was established in 1947 at Bombay and an ice and cold storage plant was put up in 1951. The vessels of the Station have completed the charting of fishing grounds off the coasts of Bombay and Saurashtra up to 40 fathom line in addition to exploratory fishing and providing training in various powered-fishing methods. The ice and cold storage plant provides the much-needed facilities for icing, storage and freezing of fish catches, and very useful technological work in this connection is also being conducted. It is proposed to further extend the activities of the Station and undertake charting of fishing grounds beyond the 40 fathom line. Exploratory fishing and charting of fishing grounds will also be undertaken further south on the West Coast and also on the East Coast in the Bay of Bengal with different types of fishing vessels. For this purpose,

exploratory fishing stations will be established at Cochin, Visakhapatnam and Port Blair. Additional facilities for cold storage and transport of fish catches and utilisation of fish wastes will also be provided.

A Fisheries Technological Station will be established to undertake investigations on designs of fishing nets and other gear likely to prove suitable in our waters; materials for the manufacture and preservation of nets and gear; storage of fish in fresh, chilled and frozen condition; processing and utilisation of fish and other marine products; and for establishing commodity standards and grades for marketing and inspection, etc.

One of the principal difficulties in implementing plans for fisheries development, on a more extensive scale and at a faster rate than at present, is the lack of adequate trained personnel. The need for the training of staff in the management and development of fisheries in States was realised several years ago and training centres for the purpose were started at the Central Marine and Inland Fisheries Research Station in 1948.

The centre at Madras was later discontinued, but is proposed to be revived at Mandapam. The ten months' training course is mostly utilised by officers deputed by State Governments, but a few private candidates are also admitted. Facilities for a short-term refresher course on fisheries research are also available at the Central Research Stations. Training in powered fishing operations is provided on the vessels of the Central Deep-Sea Fishing Station and eight fishermen are, at present, undergoing a four-year training course. Short-term training of 3-4 months was also provided to 23 State Fishery Officers on the Japanese vessel, *Taiyo Maru No. 17*. In addition, the West Bengal Government are providing training facilities on board their trawlers.

The Central Government is assisting in providing training in fishing from small mechanised boats and maintenance of engines at Satpati under a joint scheme of Saurashtra and Bombay States. Madras and Travancore-Cochin States will also shortly set up joint training centres at Cochin and Tuticorin with Central assistance. Similar training is being provided by the Norwegian Community Project in Travancore-Cochin. It is expected to train 800 fishermen at these centres. It is proposed to establish additional training centres during the Second Five-Year Plan and also increase training facilities in powered fishing when more fishing vessels and expert technicians become available.

## CHOICE BETWEEN ATOMIC AND ASTRONOMICAL STANDARDS OF TIME

ESSEN AND PARRY<sup>1</sup> described a year ago a frequency standard based on a natural resonant frequency of the caesium atom, which has been used for calibrating the quartz clock standards with an accuracy of 1 in  $10^9$  (0.0001 sec. per day). The atomic beam magnetic resonance technique first developed by Rabi and collaborators and used by these authors holds out a prospect of even higher accuracies.

Commenting on this, Sir Edward Bullard<sup>2</sup> has solicited views on the desirability of abandoning the astronomical second for the most refined measurements in view of the high precision of atomic frequency standards now available. His argument runs as follows:

Ephemeris Time, on which the definition of the second adopted by the International Astronomical Union and the International Committee of Weights and Measures depends, is derived from the motion of the Moon. If the position of the Moon at any time can be determined to 0.05 sec., a period of four years would be necessary to obtain an accuracy of 1 in  $10^9$  in time and frequency derived from astronomical observation. Essen and Parry mention Markowitz's proposals for reducing this period to one year; these depend on a reduction of the errors by repetition of observations. Such a reduction would involve a study of systematic errors in star places and in the corrections for differential refraction that would certainly take many years. During this time atomic clocks will be improved, probably by a greater factor than the astronomical determinations.

It thus seems probable that for the foreseeable future the accuracy of the measurement of frequency and of time intervals relative to laboratory standards will exceed that by astronomical means, and that the astronomically defined second is therefore incapable of realization with the accuracy necessary for microwave spectroscopy. The natural way of escape from this difficulty is to define a 'physical second' in terms of the natural period of the caesium atom, choosing the numerical value so that it agrees as well as may be with the current estimate of the second of Ephemeris Time.

In regard to the above, Clemence<sup>3</sup> directs attention to two consequences that should be well understood before the astronomical second is abandoned by physicists.

The first is, that by using the atom at once as a standard of length and of frequency the

units of length and of time lose their independence; wave-lengths and frequencies have a fixed relation to each other, the product of the two being the velocity of light. Hence it is of the utmost importance that the new units should not be exclusively employed; atomic wave-lengths must be compared with the metre from time to time, and atomic frequencies must be compared with the astronomical second. To fail to do so would be unnecessarily to restrict the science of physics at its very foundations, by assuming what can only be verified by experiment.

The other arises from the fact that an atom, while it undoubtedly gives an excellent natural standard of frequency, is not a natural clock. It is probable that two caesium standards built to the same specifications on opposite sides of the Atlantic would run at the same frequency; but if each were made to control the hands of a clock through a suitable mechanism, the two clocks would not indicate the same time (epoch). Even if they could be brought to the same time with enough precision to satisfy astronomers and geodesists—which is doubtful—if both should stop it would be impossible on starting them again to determine how much time had been lost. For actual time-keeping it will be necessary, as in the past, to rely on better mechanisms than man-made ones. The consequence, then, of adopting the new 'physical second' would be to use one second for measurements of frequency and another for actual time-keeping.

Regarding the reduction of the errors of astronomical observations by repetition, he observes that the systematic errors in star places and the differential refraction are not important limitations when periods of a year or more are considered. He estimates that with four dual-rate cameras observing the Moon, an accuracy of 1 in  $10^9$  in time and frequency derived from astronomical observations can be attained in a year, and probably 1 in  $10^{10}$  in five years. But it would appear that Bullard's argument is not affected by these estimates. He suggests therefore that before specifying the new unit of time, physicists might wait for the end of the International Geophysical Year, by which time a good number of observations of the Moon will have been made, and to compare atomic standards with astronomical ones assiduously in the meantime.

This question has also been discussed at length by Abraham<sup>4</sup> more recently. He observes that the essential requirements for the fundamental unit of time are that it must be the same whenever and wherever it is needed and that it must be susceptible of exact measurement. (The actually observed quantity need not be constant provided its relationship to the fundamental unit is known.) There can, moreover, be only one fundamental standard, and this should be the standard of Ephemeris Time. This standard should be retained be-

cause its stability and permanence are independent of its users, and also because it can be measured with sufficient accuracy for the purpose. In his opinion atomic clocks are to be recommended only as the precise and accessible sub-standards.

1. Essen and Parry, J. V. L., *Nature*, 1955, **176**, 280.
2. Bullard, E. C., *Ibid.*, 1955, **176**, 282.
3. Clemence, G. M., *Ibid.*, 1955, **176**, 1230.
4. Abraham, H. J. M., *Austr. J. Sci.*, 1956, **18**, 103.

### THE INTERNATIONAL ATOMIC ENERGY AGENCY

**A**N international agency for the development of the peaceful uses of atomic energy is to be established early in 1957, subject to the ratification of the statute by a special assembly of the UN to be held in September.

The agency will encourage and assist research, development and the practical application of atomic energy for peaceful uses throughout the world and will foster the exchange of scientific and technical information as well as the exchange of scientists and of experts among nations. Its chief purpose would be to act as a "bank" to receive, store and issue uranium fuels and other atomic materials and thus to make them available to the industries of the world beyond the borders of the few countries that can produce these materials.

Under the present draft of the statute, the agency could accept the 440 lb. of uranium-235 which the United States proposed in 1954 to contribute for international purposes, the 44 lb. allocated by the United Kingdom, and the unspecified amount that the Soviet Union has offered. None of these offers have, of course, been made to the agency as such, since it is not yet in existence. But the total would represent a large capital endowment. The U.S. Atomic Energy Commission has set a price of \$25 a gram on uranium-235, so that the amount proffered, 200,000 grams, would be worth five million dollars.

Even broader is another function of the agency. It will make provision for materials, services, equipment and facilities to meet the needs of research and the practical application of atomic energy for peaceful uses, including

the production of electric power, with due consideration for the needs of the underdeveloped areas of the world. This seems to envisage a large function of leadership in atomic development. The agency is also authorized to acquire or establish any facilities, plant and equipment useful in carrying out its authorized functions, whenever the available facilities in the area concerned are inadequate or unavailable on satisfactory terms.

Since the fissionable materials could be diverted to military purposes and since their use in atomic reactors involves the production of materials that emit radiations, the Agency will also establish and operate a complete system of safeguards, both to prevent misuse of materials, equipment or information and to assure the protection of health, life and property from possible hazards. This includes the establishment of a staff of inspectors who will be responsible for the maintenance of safeguards and protective measures, not only by the Agency itself but by member States engaged on projects under agreement with the Agency.

There is no specific provision in the draft of the statute for any study or action by the Agency with regard to the training of atomic specialists or the introduction of educational improvements that the atomic age will demand in many countries. Neither is there any consideration of the vast economic and social consequences in industry, agriculture, medicine and society. Many of these fall within the scope of present organs of the United Nations and may therefore be left to the latter or undertaken co-operatively.—UNESCO.



## WATER REQUIREMENT OF IRRIGATED WHEAT—VARIETY KENPHAD

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STUDIES on the water requirements of crops are engaging the active attention of the workers at the Central Agricultural Meteorological Observatory, Poona, under the auspices of a scheme sanctioned by the Indian Council of Agricultural Research. The design of suitable experimental techniques for assessing the water lost by evapo-transpiration is now in progress. The present note is concerned with the results of a preliminary experiment conducted during November 1954 to March 1955, on the wheat crop. The experimental arrangements tried out, functioning somewhat similarly to those of Thornthwaite<sup>1</sup> are described briefly below:

A galvanised iron tank  $5' \times 5' \times 2\frac{1}{2}'$  was buried in the field with 3" of its rim projecting over the surface of the soil. The tank was connected by means of an underground G.I. pipe line to a float mechanism, which in turn was connected to a supply reservoir through a needle valve so that a water-table could be maintained in the tank at a depth of 18" from the soil surface. The float mechanism had also an overflow arrangement to remove any excess water that tended to raise the water-table. Three such tank units were used and

the tanks were filled with soil so that the level of soil in the tanks and the field were the same. The tanks and field were planted with winter wheat crop. When the plants were one-week-old, each tank was irrigated from the top with an excess of water sufficient to cause an overflow and the overflow was collected and removed. As water was lost by evapo-transpiration, water from each supply reservoir moved into the respective field tank and daily readings of this loss was made. After 3 weeks' time, when the field was also being irrigated, each tank was irrigated with a known quantity of water sufficient to cause an overflow and the overflow was collected and measured. Any rain and the overflow from such rain during the interval between the two top irrigations were also recorded. The water requirement was given by the amount of water added to tank as top irrigation and any rain plus the amount of water lost from the supply reservoir minus the amount collected as overflow. Water requirement was estimated for 3-week intervals till the period of ear-emergence. Afterwards top irrigation was given only at the time of harvest to find out the water requirement for the period between ear-emergence and harvest. The

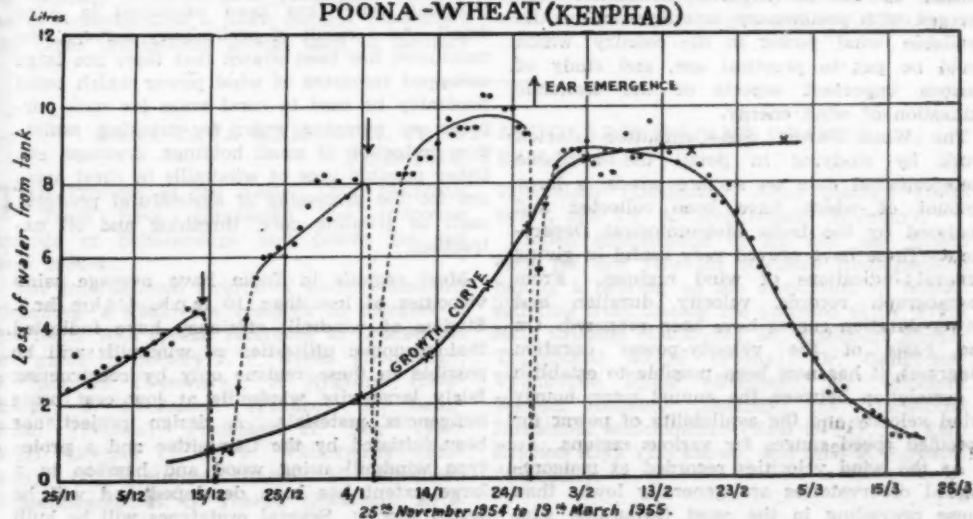
EVAPO-TRANSPIRATION EXPERIMENT  
POONA-WHEAT (KENPHAD)

FIG. 1



water requirement is expressed in terms of acre inches. The results are presented in Table I.

TABLE I

Wheat sown on 13-11-1954; germination complete on 18-11-1954; crop harvested on 19-3-1954. The average yield from tanks was 860 lb./acre.

Period	Consumption of water*
II to IV week	.. 1.7"
V to VII week	.. 2.8"
VIII to X week	.. 3.54"
XI week to harvest	.. 6.80"
Total	14.48"

\* Total for the period, average of three tanks.

It can be seen from Table I that the total water need of a wheat crop irrigated at intervals only but otherwise drawing moisture from a water-table 18" below the soil surface is of the order of 15" during the entire growing season.

Fig. 1 gives the average daily loss of water from the supply reservoir. In this is also given the growth of wheat crop in the tanks. It will be seen from Fig. 1 that the loss of water from the supply reservoir is reduced when water is added to the tanks from above but it attains a steady state in about a week. The daily loss of water from the supply reservoir is about 3 litres in the beginning of December and increases uniformly to about 9.5 litres by middle of January, i.e., about a week before ear-emergence (1 litre = 0.43 mm. of water). The period of maximum loss from tank corresponds with the period of maximum rate of elongation of the crop. The loss of water decreases after ear-emergence and particularly so after about 2 weeks.

These studies are being continued. The author is indebted to Dr. L. A. Ramdas and Shri S. P. Venkiteswaran for their guidance in conducting this investigation.

1. Thornthwaite, C. W., "Report of the Committee on Transpiration and Evaporation," *Trans. Amer. Geophysical Union*, 1946, 27.

## UTILIZATION OF WIND POWER IN INDIA

INDIA has considerable resources of wind energy which have not been utilized to any large extent so far. With a view to developing these resources, the Council of Scientific and Industrial Research set up a Wind Power Sub-Committee in December 1952 with Dr. P. Nillakantan as Convener. The Committee was charged with preliminary investigations on the available wind power in the country which could be put to practical use, and study of various important aspects of the economic utilization of wind energy.

The Wind Power Sub-Committee started work by studying in detail the available meteorological data on surface winds, a large amount of which have been collected and analysed by the India Meteorological Department. These have proved very useful in giving general indications of wind regimes. From anemograph records, velocity duration and power-duration curves have been prepared. On the basis of the velocity-power duration diagrams, it has now been possible to establish a correlation between the annual mean hourly wind velocity and the availability of power for specified speed ranges for various regions.

As the wind velocities recorded at meteorological observatories are generally lower than those prevailing in the most favourable sites in the region, the Wind Power Sub-Committee

is now engaged in a programme of making more detailed surveys in order that a proper assessment of the availability of power under optimum conditions at favourable sites may be made.

The question of utilizing wind power for pumping water has been examined in some detail. As a result of preliminary surveys, the conclusion has been drawn that there are large untapped resources of wind power which could profitably be used in rural areas for such purposes as pumping water for drinking, sanitation, irrigation of small holdings, drainage, etc. Other possible uses of windmills in rural areas are for the processing of agricultural products, such as grinding corn, threshing and oil extraction.

Most regions in India have average wind velocities of less than 10 m.p.h. (16 km./hr.). Studies of windmill efficiency have indicated that economic utilization of windmills will be possible in these regions only by constructing fairly large size windmills at low cost using indigenous materials. A design project has been initiated by the Committee and a prototype windmill using wood and bamboo to a large extent has been developed and will be tested shortly. Several prototypes will be built and tested.

With regard to electricity generation through wind power the field in India is more restricted although regions in Saurashtra and Coimbatore are promising. A 6 to 8 KW wind-electric plant of German make is being obtained for experimental purposes. Large-scale use of such plants will be possible only after determining the most effective way of operating them with either batteries or auxiliary power systems.

A proposal is now under consideration by the Government of India for utilization of wind power on a large scale in accordance with a phased programme. It is contemplated to use more than 20,000 small windmills in rural areas and perhaps a few hundred medium-

sized wind electric plants for electric supply, for the operation of pumping installations and for supply of electricity in out-of-the-way localities for light-houses, plantations, etc.

The Wind Power Sub-Committee is now organizing the setting up of 20 wind survey stations in various regions in the country and expects to operate a few more pilot installations including the low cost type developed by the Committee and the 6 to 8 KW wind electric plant.

In all work relating to wind velocity surveys, the Wind Power Sub-Committee is being assisted by the India Meteorological Department.

### STUDIES ON RADIATION PROBLEMS

THE radiation dangers involved in working in atomic plants, or in laboratories and other institutions where radio-isotopes are used, were discussed at a recent meeting of scientists and medical men called by the World Health Organization in Geneva. The group recommended that standards laid down by the International Commission on Radiological Units should be used as widely as possible and that radio-isotopes should be handled only by technically qualified persons.

A second problem examined was that of training personnel in methods of protection. Besides the training of "health physicists" specializing in radiological protection, the experts recommended a more general instruction for other professional groups such as sanitary

engineers, public health administrators, ecologists and reactor engineers. The need for doctors trained in the medical use of radioactivity and in radiation protection was particularly stressed. The group recommended that instruction in these subjects be included in the curricula of medical schools.

Lastly it was emphasized that radiation hazards were likely to become a public health problem for entire continents. The possible pollution of rivers crossing several countries was particularly mentioned in this connection. It was urged that WHO should encourage the creation by competent bodies of international disposal areas where highly radioactive materials could be safely put away.—UNESCO.

### LADY TATA MEMORIAL TRUST SCHOLARSHIPS AND GRANTS FOR THE YEAR 1956-57

THE Trustees of the Lady Tata Memorial Trust have announced the following awards of Scholarships and grants for the year 1956-57.

The International awards of varying amounts (totalling £ 6,962) for research in diseases of the blood with special reference to Leucaemias are made to Doctors J. F. Kieler (Denmark), J. Ringsted (Denmark), J. Rygaard (Denmark), J. Nordmann (France), M. Seligmann (France), Professor H. Teir (Finland), Doctors C. G. V. Wasastjerna (Finland), G. Marinone (Italy), M. Simensen (Copenhagen), B. G. Thorell (Sweden), A. J.

Therkelsen (Denmark), Alice Stewart (England), and Dr. A. Sreenivasan (Bombay).

Indian Scholarships of Rs. 250 per month each for one year for scientific investigations having a bearing on the alleviation of human suffering from disease are awarded to Dr. Prem Nath Satsangi (Lucknow), Dr. Mahendra Kumar Trambaklal Mehta (Patna), Dr. Gangadhar Vyankatesh Bhide (Bombay), Mr. Umakant Waman Kenkare (Bombay), Dr. Hargobind Jashanmal Mulchandani (New Delhi), Dr. Ram Krishna Arya (Lucknow), and Miss P. Parvathi (Calcutta).

## UTILIZATION OF SOUTH ARCOT LIGNITE CHAR AS DOMESTIC FUEL

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THIS paper summarises the results of an investigation carried out on the use of South Arcot lignite char as domestic fuel. The development of a suitable and reasonably economic substitute for charcoal from South Arcot lignite<sup>1</sup> will go a long way in easing the domestic fuel situation, preventing cutting down of forests for domestic fuel supplies and finding better utilization for cow dung.

The char obtained by the carbonization of air-dried South Arcot lignite at about 500° C. in a locally designed and fabricated carbonizer, which can treat about 80 lb. of lignite at a time, was used in these tests. For the first series of five tests, the char was obtained from lignite from borehole number 161. In this case, 45 lb. of this material was carbonized at 510° C. In the second series of five tests, the char was from lignite sample from several boreholes and pit number 3 carbonized at 520° C. The charcoal available locally was used in the third series of tests.

Every test consisted of preparing boiled rice as per local household practice from weighed amounts of water, rice and fuel. About 200 g.

of fuel were weighed and equal quantities of rice and water were used in all tests. The same household hearth (open fireplace) was used in all the experiments.

A weighed amount of fuel was first placed on the grate, and ignited by a torch prepared from a small amount of coconut fibre dipped in kerosene. The fuel was allowed to catch fire and when the cooking was over, the rice vessel was removed from the hearth and the residual fuel was put in a closed container for cooling. Its weight was determined after cooling. The proximate analysis, calorific value and sulphur content of the samples of char and charcoal and the proximate analysis of the residual material were determined.

Table I gives the analysis (before and after use) of lignite char and charcoal used in the three series of tests, and also the actual consumption of the fuel. It shows that the volatile matter and ash contents of the lignite char are in line with those in charcoal, but the sulphur content in the former is more. The fuel consumption was calculated on moisture and ash-free basis.

TABLE I  
*Comparison of lignite char and charcoal as domestic fuel*

Material used	Series I 1-5 Expts. Lignite Char*	Series II 6-10 Expts. Lignite Char†	Series III 11-15 Expts. Charcoal
<b>BEFORE USE—</b>			
Moisture %	6.83	7.78	4.54
Ash %	6.06	7.07	4.54
Volatile matter %	7.62	10.57	13.01
Fixed carbon %	79.49	74.58	77.91
Calorific value B.T.U./lb.	12,090	11,770	12,780
Sulphur %	0.52	0.49	0.18
<b>AFTER USE—</b>			
Moisture %	8.94 to 10.00	8.84 to 9.73	7.27 to 8.70
Ash %	7.32 to 10.60	8.10 to 11.78	6.00 to 8.30
Volatile matter %	7.08 to 8.89	6.74 to 10.35	8.32 to 10.49
Fixed carbon %	71.57 to 75.95	68.03 to 79.76	74.74 to 77.57
Calorific value B.T.U./lb.	10,950 to 11,160	9,640 to 11,280	11,050 to 11,660
Sulphur %	0.62	0.63	0.19
Weight of material before use g. (moisture and ash-free)	244.1	170.3	254.8
Weight of material after use g. (moisture and ash-free)	151.4 to 166.9	87.3 to 97.8	129.9 to 150.3
Consumption of fuel g.	72.2 to 92.7	72.5 to 83.0	104.50 to 124.9
Average consumption g.	84.8	79.8	118.0

\* Lignite from several boreholes and pit No. 3 (pilot pit from which about 60 tons of lignite was raised).

† Lignite from borehole No. 161 (one of the boreholes dug for proving lignite bed).

TABLE II  
Details of experiments

Experiments	Material	Weight of fuel g.	Weight of residue g.	Ignition time min.	Total time min.	Weight of rice g.	Weight of water g.
I series, 1 to 5	Lignite Char*	280.2	185.3 to 200.6	6 to 9	33 to 35	350.3	840.7
II series, 6 to 10	Lignite Char†	200.0	105.45 to 119.3	7 to 8	31 to 34	363.8	1000.0
III series, 11 to 15	Charcoal	280.2	161.6 to 173.6	4 to 5	28 to 34	350.3	840.7

\* Lignite from borehole No. 161. † Lignite from several boreholes and pit No. 3.

Table II gives the data with regard to the details of the experiment.

These data indicated that the consumption of fuel was lower, when lignite char was used. The average fuel consumption in the first series was 84.8 g. for the charge of rice and water used, in the second series 79.8 g., and in the third series (when charcoal was used) 118.9 g. On the whole, lignite char consumption was 28.7% less than charcoal. The lower consumption of lignite char is in line with what was found by Ratnam *et al.*<sup>2</sup> in its utilisation as bus fuel. The per cent. reduction is about the same in both cases and the calorific value of the fuel is not a factor in fuel consumption in this case, as can be seen from the fact that charcoal has greater calorific value than the two lignite chars used. The nature and the burning qualities seem to be controlling factors here. Studies on this are under way.

The ignition time in the case of lignite char

was generally 3 to 4 minutes longer than when charcoal was used, but the total time taken for the entire cooking operation was about the same in both cases. Hence, no ultimate delay was involved in using lignite char as domestic fuel. Although the sulphur content in lignited char was higher than in charcoal, it was still low and in actual practice did not cause any inconvenience. As these tests were carried out in a kitchen using an open hearth in daily use, these observations will apply to the conditions that are likely to prevail in most houses in S. India.

The authors thank Smt. C. Sarojini Devi for her help in carrying out these tests and the Government of India for permitting the publication of these results.

1. Ratnam, C. V. S., *Madras Information*, August 1953, 44.
2. —, Ramanathan, V. S. and Veeraraghavan, S., *J. Sci. Ind. Res.*, 1955, 14 B, 604.

## BHILAI STEEL PROJECT

THE Government of India have accepted the detailed Project Report for the Bhilai Steel Works, furnished by the Soviet authorities. The proposed plant will consist of three blast furnaces for producing iron. By the use of high top pressure and sintering of iron ore, the output of the blast furnaces will be increased significantly. Steel will be produced by the straight basic open-hearth process in six open-hearth furnaces. Ingots produced will be 6-7 tons in weight. The large 1,150 mm. blooming mill will be capable of handling 10-ton ingots. The rolling mills are of modern design and layout, and incorporate technological improvements well proved in the U.S.S.R. The capacity of the plant will be, besides 300,000 tons of pig iron, 1 million tons of ingots yielding about

770,000 tons of rails, heavy and medium structurals, light structurals, sleeper bars and billets. With slight additions to the plant, such as an additional open hearth and a group of soaking pits, its capacity can be raised at any time to 1.3 million tons of ingots. No further additions of rolling mills will be required to finish the additional ingots. Apart from this, the plant will be so laid out that it can be expanded to produce up to 2.5 million tons of ingots.

The steel works are expected to achieve full production by December 1959, but two coke oven batteries, two blast furnaces, two open-hearth furnaces and the blooming mill will be commissioned about a year earlier.



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NEW EMISSION SPECTRA OF ICl  
AND IBr

New emission spectra of ICl and IBr have been obtained in condensed transformer discharge using a 20 K.V. transformer and in high frequency discharge using 50 and 100 watt oscillators. Spectra were photographed in the visible region with three prism Littrow and Fuess spectrographs, in the quartz ultraviolet region with a Medium Quartz instrument and in the fluorite region with a one metre normal incidence vacuum grating spectrograph.

The spectrum of ICl revealed an extensive system of about 300 bands in the region  $\lambda$  4400 to  $\lambda$  3800. These bands are sharp and are clearly degraded towards longer wave-lengths. The two systems reported in the fluorite region by Cordes and Sponer<sup>1</sup> in absorption are also recorded. The two well-known visible

systems reported in absorption are not observed in the present experiments. The emission spectrum of ICl as excited in an uncondensed transformer discharge consists of only a number of continuous bands in the region  $\lambda$  5650 to  $\lambda$  3700.<sup>2</sup> In addition to the above discrete band systems, our photographs reveal two continuous bands, one in the region  $\lambda$  4620 to  $\lambda$  4500 and the other at  $\lambda$  5350.

The spectrum of IBr has been excited under similar conditions. The characteristic bluish, violet emission surrounding the intense discharge due to the atomic line spectra, when photographed with a Fuess glass instrument revealed a brief system of about 25 bands in the region  $\lambda$  3900 to  $\lambda$  3800. In the fluorite region the two brief systems at  $\lambda$  1980 to  $\lambda$  1850 and  $\lambda$  1790 to  $\lambda$  1740 have also been recorded. The photographs also show some of the continuous bands which have earlier been re-



ported by Asundi and Venkateswarlu<sup>2</sup> in an uncondensed discharge through IBr.

Both the spectra of ICl and IBr have also been excited in a high frequency discharge from a 50 watt oscillator. The discrete band systems reported above are absent in this source, while the two brief systems in the fluorite region of each of these molecules have been obtained. The vibrational analysis of the two systems of ICl and IBr have led to the determination of the following vibrational constants.

TABLE I

	$\nu_{00}$ cm. <sup>-1</sup>	$\omega_e$ cm. <sup>-1</sup>	$\chi_e'$ cm. <sup>-1</sup>	$\omega_e''$ cm. <sup>-1</sup>	$\chi_e''$ cm. <sup>-1</sup>
ICl	23824	173.2	1.1	209.7	1.9
IBr	25936	104.0	0.8	140.0	1.9

The two systems are analogous and arise from the same electronic transition. The lower state in each case is identified as a  $^3\Pi'$  which is the upper state of the two low frequency systems of ICl and IBr observed in absorption. The electronic transition involved is

TABLE I

$\Delta v$	Int	App	$\rho$	$\Delta v$	Int	App	$\rho$	$\Delta v$	Int	App	$\rho$
157*	100	vb	.77	757	4	vd	.86	1157	13	sh	.81
180*	17	sh	.80	792	1	vb	..	1234	30	sh	.15
262*	32	b	.86	821*	34	sh	.18	1261	8	sh	.35
298*	56	sh	.36	845	2	b	..	1282	3	b	.71
441	1	b	..	874	1	b	..	1390	4	b	..
472*	14	vsh	.44	970	2	sh	..	1446	4	b	..
530*	4	vd	..	1001	1	vsh	..	1479	5	b	..
545*	29	b	.38	1026*	58	vsh	.15	1590	32	sh	.66
595	1	b	..	1049	2	bd	..	3020	4	vb	.62
654*	34	vsh	.16	1061	5	b	.23	3065	43	sh	.39
678	1	b	..	1115	6	sh	.44	3085	43	sh	..
697	3	b	..	1136	2	sh	..	3173	4	vb	..

identified as  $1\Sigma^+ - ^3\Pi$  or case C equivalent  $0^+ - 1$ , in accordance with the term scheme of ICl given by Mulliken.<sup>3</sup>

Full details will be published shortly.

Dept. of Physics, P. B. V. HARANATH.  
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# RAMAN SPECTRUM OF O-FLUOROBROMOBENZENE

THE Raman spectrum of o-fluorobromobenzene was obtained in the liquid state. There is no previous report on the Raman spectrum of this compound excepting for the interpolated frequencies given by Kohlrausch.<sup>1</sup> Mercury 4358 Å radiation, filtered through the 'Du Pont Rhodamine 5 GDN extra' dye in p-nitrotoluene-ethyl alcohol solution, was used for excitation.

About 36 Raman lines were recorded and the shifts are given in Table I. Lines marked with asterisks were obtained as Stokes as well as antistokes lines. The depolarisation factors were determined by the simultaneous exposure method using a quartz double image prism to separate the horizontal and vertical components. The relative intensities of these two components were determined by the photographic method. The intensities of the lines, given in the second column of the table, are only semi-quantitative in that they are not corrected for the plate sensitivity variation. The abbreviations used to denote the appearance of the lines are: sh=sharp, vsh=very sharp, d=diffuse, vd=very diffuse, b=broad, and vb=very broad.

The author is grateful to Dr. G. C. Finger of the Illinois State Geological Survey for the

gift of the sample and to the Government of India for the award of a senior research scholarship. The author is deeply indebted to Prof. K. R. Rao for his valuable guidance.

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April 15, 1956.

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# RELATION BETWEEN R.B.C. COUNT AND ALTITUDE

PIONEERING work on high altitude physiology was described by Haldane, Priestley, Douglas and Barcroft.<sup>1,2</sup> Since then it became well known that the red blood corpuscle count in man increases with altitude. Since at higher altitudes, the atmospheric pressure and consequently the partial pressure of oxygen falls considerably below normal, it is explained that the R.B.C. count and the haemoglobin content of blood increase proportionately, to make up for the depleted oxygen absorption and thereby bring the total oxygen supply as near the normal requirement as possible.<sup>3,4</sup> Barcroft gave an empirical relation between the R.B.C. count and the altitude.<sup>5</sup> However, a mathematical relation between these two quantities, based on theoretical grounds, which could quantitatively predict the R.B.C. count at any specified altitude does not seem to have been worked out so far. The present note reports a study of this type.

Experiments at high altitudes and those with reduced oxygen tensions in laboratories at sea-level lead to similar results on R.B.C. count.<sup>1</sup> Thus, the problem is obviously governed by the same principles as the oxygen dissociation curve at various oxygen tensions. Hence the desired relation can be deduced from the following equation for the oxygen dissociation curve of blood<sup>6</sup>

$$Y = \frac{(100-S)e^{eK_1p}}{(1+K_1p)} \cdot \frac{(1+p)}{(1+p+K_2p')} \quad (1)$$

where  $Y$  is the oxyhaemoglobin in blood,  $(100-S)$  is the haemoglobin available for oxygen absorption,  $e$  is the base of natural logarithms,  $h$  is  $(eK_1 - eH)$  which is constant for any individual blood,<sup>7</sup>  $p$  is the oxygen tension,  $p'$  is the carbon dioxide tension and  $K_1$  and  $K_2$  are constants. Since in ordinary atmosphere, the carbon dioxide tension  $p'$  is negligible, the last factor in the right-hand side of the above equation reduces to unity and the equation can then be transposed to the form:

$$(100-S) = c_1 Y + c_2 Y/p \quad (2)$$

where  $c_1$  and  $c_2$  are constants since  $h$  and  $K_1$  are constants.

Here  $p$ , the oxygen tension, is proportional to the atmospheric pressure and is therefore related to the altitude  $A$  by the well-known equation:

$$p = p_0 e^{-kA} \quad (3)$$

where  $k$  is a constant, and  $p_0$  is the oxygen tension at sea-level, again a constant.

Man's normal requirement of oxygen and the amount of oxyhaemoglobin in his blood, i.e.,  $Y$ , should be constant at any altitude. Thus the available haemoglobin in his blood  $(100-S)$  and hence the R.B.C. count (say,  $n$ ) to which this haemoglobin is proportional, should increase with altitude, in order to maintain  $Y$  constant. Thus equation (2) transforms to  $n \propto abe^k$  which may be put in the form

$$\log_{10} n = C + KA \quad (4)$$

where  $C$  and  $K$  are constants.

Thus, a plot of  $\log n$  against  $A$  should be a straight line according to equation (4); and the R.B.C. count  $n$  plotted against the altitude  $A$  should give an exponential curve, as against the empirical linear relation of Barcroft and others.<sup>3,5</sup> These are borne out by the straight line I and the curve II in Fig. 1, drawn for the experimental data given by Barcroft.<sup>5</sup> From observations of atmospheric pressures at various known altitudes<sup>8</sup> and from theoretical considerations,<sup>9</sup> the value of  $K$  is found to be  $3.92 \times 10^{-5}$ , while from the experimental data on R.B.C. count and from the graphs in Fig. 1, the value is calculated to be  $4.0 \times 10^{-5}$ . The agreement is very good, particularly since the data in support of this paper are from experiments on human subjects. This affords an additional proof of the validity of equation (4).

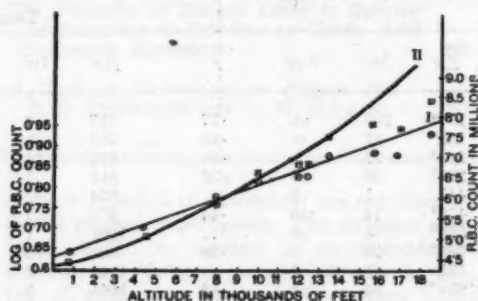


FIG. 1.

I  $\log_{10} n$  against  $A$ ; II  $n$  against  $A$ .

It is interesting to observe that at an altitude of 15,000 feet and above, the actual R.B.C. count is less than the theoretical amount required according to equation (4). This must be so because the R.B.C.-producing capacity of the body being limited, it is unable to supply the large amount of R.B.C. required at these altitudes. Thus, the symptoms of anoxia and mountain sickness become manifest at these altitudes and above.<sup>10</sup>

The author is grateful to Prof. K. V. Subbarao, Officer-in-Charge of the Regional Labora-

tory and to Prof. G. Gopala Rao of the Andhra University, for their interest.

Regional Laboratory,  
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### HIGHLY WATER-REACTIVE FORMS OF TRANSITIONAL ELEMENTS OF THE IRON GROUP

In the course of our investigations on the isolation of non-metallic inclusions in steel by anodic dissolution of the base metal, we observed that the iron, deposited on the cathode under some specific conditions, showed remarkable reactivity with water even at room temperature (25° C. to 30° C.), accompanied by copious evolution of hydrogen. All the earlier studies on the reaction of iron with water<sup>1</sup> show that it is extremely slow at ordinary temperatures. Thus, the present observation seems to be rather unique and therefore systematic studies had been undertaken regarding the isolation and reactivity of this form of iron. The salient features of the interesting results obtained may be summarised as follows:

**Isolation.**—(i) It is necessary to have an electrolytic bath capable of resisting changes of pH, which should be maintained between 4 and 6. It should also prevent precipitation of iron as hydroxide by forming a complex with it. A strong solution of sodium citrate is very effective in this regard. (ii) The addition of an electrolyte like sodium chloride is helpful in increasing the conductivity of the bath and improving anodic dissolution. (iii) Sufficiently high current density is necessary to maintain the rate of deposition well above that of the reverse reaction of the active metal with the electrolyte. (iv) The reverse reaction can be

further minimised by keeping the bath at a fairly low temperature (20–25° C.). However, too low a temperature should be avoided for preventing the separation of the dissolved salts. (v) It is desirable to have as high a ferrous ion concentration as possible to offset the depletion of metal ions by complex formation. (vi) The reactive iron can be conveniently deposited on strips of platinum, aluminium, copper, nickel, iron or tin used as cathodes with pure iron as anode.

**Reactivity.**—(i) This form of iron reacts very readily with water even at room temperature (25–30° C.) accompanied by copious evolution of hydrogen, the reactivity being easily comparable to that of calcium. (ii) During the reaction, the pH of water progressively increases, resulting ultimately in a deep pink colour with phenolphthalein. (iii) Increasing the temperature of water greatly enhances the rate of reaction, the final pH being even higher than in the previous case. (iv) In all these experiments an inactive film forms on the surface along with the progress of the reaction. This in due course covers the entire surface, thus protecting the metal from further reaction. (v) The inactive film can be removed by dissolution in dilute acids or strong sodium citrate solution whereby a fresh surface of metal, showing the same reactivity with water, gets exposed and the reaction proceeds to completion. (vi) The deposited metal retains its activity for a few hours when kept dry under vacuum. Exposure to air and moisture renders the surface inactive, but if this is treated with dilute acids or strong sodium citrate solution, the reactivity manifests itself again, though markedly reduced in vigour. (vii) It has been found that at higher temperatures, the active form gets transformed to the inactive variety as evidenced by its inability to react with water.

Further work on the other two metals of the iron group, viz., cobalt and nickel, has shown that they can also be obtained in similar highly reactive forms. It may, however, be stated that the deposit of cobalt shows a fairly vigorous reaction with water, whereas, in the case of nickel the enhanced reactivity can be easily observed in very dilute acids with which other familiar forms of the metal do not react. Thus the water reactivity of these metals diminishes in the order of their positions in the Periodic Table.

We may recall in this connection that, to explain the well-known and rather anomalous high deposition potentials of the transitional

elements of the iron group, Glasstone<sup>2,3</sup> assumed their initial deposition in active metastable states. The present investigations clearly show that we have isolated similar reactive forms of these metals.

Further particulars will be published elsewhere.

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#### AGAR ELECTROPHORESIS OF HAEMOGLOBINS

THE agar electrophoresis technique<sup>1-3</sup> developed in this Department for the study of serum protein patterns has been applied to investigations of abnormal haemoglobins in human blood. A brief description of this technique is reported here in the hope that the technique being simple will be of considerable use in the routine examinations of blood for the presence of abnormal haemoglobins.

The haemoglobin solutions were prepared from citrate blood by the method of Drabkin,<sup>4</sup> without using aluminium chloride.

2-5 microlitres of the haemoglobin solution depending on the concentration is applied by paper strip application technique on the surface of the agar gel (1% containing veronal-acetate buffer of pH 8.6, ionic strength 0.05) and subjected to electrophoresis according to the procedure described before.<sup>2</sup> A voltage of 180-200 is used and the electrophoresis is carried out for 8-9 hrs. The current varies between 8-9.5 m.A. After electrophoresis the haemoglobin bands can be seen clearly on the surface of the gel. If the concentration of the haemoglobin is low in the case of minor components, the band can be observed under ultraviolet light with Wood's filter. For quantitative evaluation of the bands, the agar gel, after drying is stained with Amido Black dye solution according to the procedure described before<sup>2</sup> and the densitometric evaluation of the components can be made by means of an electronic densitometer. Typical patterns of haemoglobins of normal blood and the blood of

a patient with a positive sickling trait (obtained from a case belonging to the aboriginal tribe, Kurumba, in Nilgiris), together with the densitometric curves obtained by a Photovolt Electronic Densitometer, Model 525, are shown in Fig. 1. It is clear from the patterns that

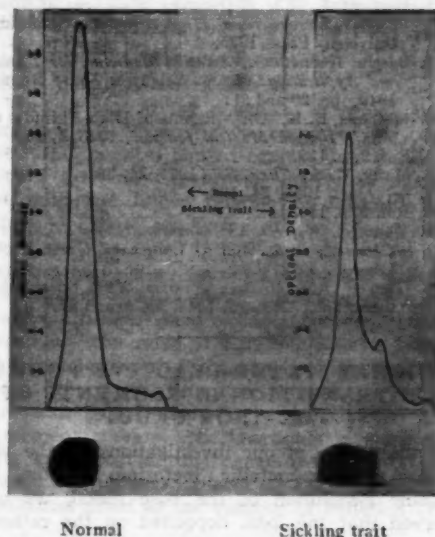


FIG. 1. Agar electrophoretic patterns of human haemoglobin types.

normal human blood shows a single haemoglobin component (Haemoglobin A), while that of the patient with the sickle cell trait shows the characteristic pattern, which consists of the major component, haemoglobin A and a minor component, haemoglobin S. The resolution of the two components is good and reproducible. Another characteristic feature of sickle cell trait pattern is that the haemoglobin bands are more diffuse than those of normal haemoglobin.

Another faint component towards the cathode side of the origin appears on the pattern in both normal and sickle cell trait blood. This component is an associated protein impurity which can be eliminated by repeated washing of the blood cells with saline solution. The agar electrophoretic patterns can also be obtained on cellophane or polyester films.<sup>3</sup> It may be noted here that the pattern is shifted slightly towards the cathode side due to electro-osmosis. Examination of chicken blood has shown two distinct haemoglobin components, whose mobility was found to be much lower than that of human haemoglobin. The faster moving component ( $\alpha$ -haemoglobin) is present



in lower concentration than the slower moving component ( $\beta$ -haemoglobin), which is in conformity with the observations made by Johnson and Dunlap.<sup>5</sup> A comparative electrophoretic pattern of chicken hemolysate and normal human serum protein is shown in Fig. 2. It

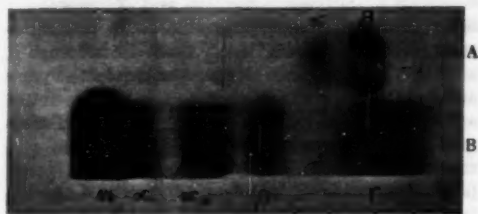


FIG. 2. Agar electrophoretic patterns of chicken haemoglobins and normal human serum proteins.

(200 volts; 6.5 m.A.; pH 8.6; 0.05 I.S.; 6 hrs. run.)

A—Chicken blood haemolysate.

B—Normal human serum.

may be seen from the pattern that the mobility of the major component is slightly higher, while that of the minor component is much higher than that of gamma-globulin.

Investigations on the haemoglobin patterns of other animal species and normal as well as pathological blood cells are in progress. The agar electrophoretic technique being simple and inexpensive, affords an easy and convenient method for use in the investigation of abnormal haemoglobin traits in various populations in India. Full details of these investigations will be published elsewhere.

Our thanks are due to Mr. P. K. Sukumaran of 'Human Variation Unit', Indian Cancer Research Centre, Bombay, for kindly making available to us the hemolysate of sickle cell trait patient. The sickling phenomenon has been confirmed by him by microscopic examination.

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### EFFECT OF ADDITION OF IRON COBALT AND ASCORBIC ACID TO THE MEDIUM ON THE SYNTHESIS OF ASCORBIC ACID IN MOLDS

The synthesis of ascorbic acid by molds has been reported by several workers.<sup>1,2</sup> Certain interesting observations regarding the role of iron, cobalt and ascorbic acid in the biosynthesis of ascorbic acid by the mold (*Aspergillus flavus*) isolated from moldy groundnut seeds are recorded in the present communication.

The mold was grown in 25 ml. of the medium containing sucrose, 0.38 g.; sodium nitrate, 0.05 g.; dipotassium phosphate, 0.025 g.; magnesium sulphate, 1.025 g.; potassium chloride, 1.025 g.; and ferrous sulphate traces, (the pH of the medium was adjusted to 3.8 and autoclaved at 10 lb. pressure for 10 minutes) at 37°C. for 3 days. After the period of incubation, the mats were removed and extracted with 25 ml. of distilled water. The ascorbic acid content in the filtrate and the mat extracts was estimated spectrophotometrically using 2, 6-dichlorophenolindophenol. 0.5 ml. of the sample was taken in 25 ml. volumetric flask to which were added 5 ml. of citrate buffer, pH 3.8 and 12.5 ml. of 6% metaphosphoric acid and the whole diluted to 25 ml. To 5 ml. of this was added 5 ml. of 2, 6-dichlorophenolindophenol (1.6 mg./100 ml.) and the colour was read immediately at 520 m $\mu$  in Beckman DU spectrophotometer (1 cm. light path) against the blank containing all except the vitamin solution. A standard graph of optical density at 520 m $\mu$  against  $\mu$ g. ascorbic acid was plotted using standard amounts of ascorbic acid and the ascorbic acid present in the sample was calculated from this graph.

TABLE I

	Wt. of the mat in g.	mg. ascorbic acid in 100 ml. filtrate	mg. ascorbic acid in 100 g. mat
Complete system	0.2012	0.030	5.235
" +2 $\gamma$ Co	0.1456	0.100	9.131
" +4 $\gamma$ Co	0.1612	0.080	6.825
" +8 $\gamma$ Co	0.1752	0.040	6.525
" +2 $\gamma$ A.A.	0.1528	0.090	8.328
" +4 $\gamma$ A.A.	0.1621	0.060	7.710
" +8 $\gamma$ A.A.	0.1752	0.045	6.782
" -Fe	0.1752	0.050	6.526
" -Fe+2 $\gamma$ Co	0.1374	0.105	9.831
" -Fe+2 $\gamma$ A.A.	0.1483	0.110	9.528

Table I gives the result of the addition of different amounts of cobalt and ascorbic acid to the medium, with and without the addition



of iron, on the growth of the mold and the biosynthesis of ascorbic acid.

It is found that the biosynthesis of ascorbic acid is inhibited by the addition of iron, but that this depressing effect is countered by the addition of cobalt (2%) or ascorbic acid (2%). The effects of the addition of cobalt and ascorbic acid are more pronounced in the absence of iron.

Further work is under progress and the details will be published elsewhere.

Our thanks are due to the Chief Mycologist, I.A.R.I., Delhi, for identifying the mold.

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### EFFECT OF AUREOMYCIN, NITRITE AND RICINOLEATE ON RED HALOPHILIC BACTERIA\*

THE red salt organisms known to be responsible for the reddening of salted fish<sup>1</sup> and hides cause considerable loss to the trade. Since Canadian workers<sup>2</sup> have successfully used aureomycin and nitrites in the preservation of

fresh fish, it was thought desirable to see if these could control the red halophiles also. Hess and Gibbons<sup>3</sup> have also studied the effect of  $\text{NaNO}_2$  on red halophiles. The pure cultures used in these experiments were *Pseudomonas salinarum*, *Ps. cutirubra*, *Bacterium trapanicum*, *B. halobium*, *Micrococcus morrhuae*, *M. roseus halophilus*, *Sarcina littoralis* and *S. morrhuae*. Some cultures isolated and studied in this laboratory<sup>4</sup> also have been used. Aureomycin, sodium nitrite, and sodium ricinoleate were aseptically added to a modified salt-skim-milk-agar (pH  $6.5 \pm 0.1$ ) and plates poured in 'Felsen' quadrant dishes. Surface inoculation was made by streaking. The inoculum was prepared in 20% sterile brine to give visible turbidity. Growth in the control and other media was recorded. The results are tabulated in Table I.

It is clearly seen that even 10 p.p.m. of aureomycin had no effect on the red halophilic bacteria. In fact, growth was as profuse and rapid as in control. There was not even a longer lag. No morphological changes were noticed in the rod forms or cocci grown in the presence of 10 p.p.m. aureomycin. This is in fact surprising because far smaller quantities of aureomycin suppressed mesophilic bacteria in fresh fish. The ineffectiveness of aureomycin in restraining infection due to red halophilic bacteria has been noted by Canadian workers<sup>1</sup> also. It is not clear whether the high  $\text{Mg}^{++}$

TABLE I  
Effect of aureomycin, nitrite and ricinoleate on red halophiles

Culture	Control	Aureomycin p.p.m.		Sodium nitrite %					Sodium ricinoleate %	
		4	10	0.05	0.10	0.15	0.20	0.5	0.5	0.5
<i>Pseudomonas salinarum</i>	..	++	++	+	-	-	-	-	++	++
<i>Ps. cutirubra</i>	..	++	++	+	-	-	-	-	++	++
<i>Bacterium halobium</i>	..	++	++	+	±	±	±	-	+	-
<i>Bacterium trapanicum</i>	..	++	++	+	-	-	-	-	-	-
<i>Sarcina littoralis</i>	..	++	++	++	++	+	+	+	-	-
<i>S. morrhuae</i>	..	++	++	++	++	++	+	-	-	-
<i>Micrococcus morrhuae</i>	..	++	++	++	++	++	+	-	-	-
<i>M. roseus halophilus</i>	..	++	++	++	++	++	+	+	-	-
H 18 ( <i>Halobacterium indicum</i> N.sp.)	}	++	++	++	0	0	0	0	-	-
H 41 ( <i>Halobacterium minutum</i> N.sp.)		++	++	++	0	0	0	0	0	0
H 45 ( <i>Halobacterium gibbonsii</i> N.sp.)		++	++	++	0	0	0	0	0	0
H 36, H 16 ( <i>Sarcina</i> sp.)	++	++	++	0	0	0	0	++	0	0
H 40 ( <i>Sarcina marina</i> N.sp.)	++	0	0	0	0	0	0	-	-	-

++ = Excellent growth; + = Fair growth; ± = Poor delayed growth; - = No growth; 0 = Not tested.

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content (which is essential for better growth of red halophiles) of the medium reverses the toxicity of aureomycin, as has been suggested by Eagle and Saz<sup>4</sup> in the case of *B. subtilis* and *Ps. aeruginosa*.

The effect of nitrites is variable with different organisms. *Ps. salinaria*, *Ps. cutirubra* and *Bact. trapanicum* did not grow in the presence of 0.1%  $\text{NaNO}_2$  though poor delayed growth was noted with 0.05%. *Bact. halobium* grew well in the presence of 0.05%  $\text{NaNO}_2$  but very slight growth was obtained even at 0.2% level, though not at 0.5%. In the case of the cocci growth was not retarded by 0.1%  $\text{NaNO}_2$ , though 0.2% delayed but did not arrest their growth. With 0.5% *M. roseus halophilus* still grew and *Sarcina littoralis* also showed delayed growth. Our laboratory cultures of *Sarcina* sp. (H 15 and 36) also grew well in this concentration of  $\text{NaNO}_2$ . Sodium ricinoleate had just the opposite effect. The cocci were suppressed but the rod forms grew even in 0.5% concentration with equal felicity as in control. The suppression of the cocci may be due to the depression of surface tension as reviewed by Werkman and Wilson.<sup>5</sup> High concentrations of nitrites are not recommended for edible articles such as salted fish but a combination of 0.2%  $\text{NaNO}_2$  and 0.2% sodium ricinoleate may be effective in salting hides.

We are grateful to Lederle Laboratories (India) Ltd., Bombay, for the gift of aureomycin.

Fisheries Technological Station, Kozhikode,  
March 12, 1956.

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A. SREENIVASAN.

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# A COMBINED TECHNIQUE FOR MACERATION AND BLEACHING OSMIUM BLACKENING IN ROOT TIPS OF ORYZA

In a tropical country like India where high temperature prevails, the osmium present in tissues fixed with osmic combinations causes further blackening when the latter passes through the paraffin-bath at 56-58°C. The root tips of *Oryza*, chilled, fixed in La Cour 2 BE, blocked, cut and bleached either with alcoholic hydrogen peroxide or with chlorine vapour gives very poor preparations after staining in crystal violet. Therefore it was found necessary to adopt other means of bleaching at room temperature.

Lee's *Vade Mecum*<sup>1</sup> lists several methods to remove blackening, of which some have been developed in connection with the animal material. Of the several methods listed, post-fixation treatments such as, soaking in aqueous solutions of chromic acid, bichromate of potash and in turpentine and dioxan were tried and found not suitable for *Oryza* root tips.

John McLeish<sup>2</sup> mentions the use of an equal mixture of saturated aqueous ammonium oxalate and 20 volume hydrogen peroxide as a method to soften and bleach the root tips of *Vicia faba* fixed in La Cour 2 BD. A suitable technique for *Oryza* was worked out on a similar line. It was found that a weak concentration of the above mixture was sufficient with *Oryza* root tips.

The technique is as follows:

1. Fix root tips in La Cour 2 BE (6-8 hr.).
2. Wash the fixed material in water (5 min.).
3. Soak the washed root tips in 1% aqueous solution of ammonium oxalate (10-15 min.).
4. Add to the above 3-5 drops of fresh 20 volume hydrogen peroxide. Control the intensity of reaction by dilution with 70% alcohol.
5. Wash the bleached root tips thoroughly for 15-20 min. in water.

Bleaching turns root tips to a pale yellowish colour in 5-10 min. The bleached root tips can then be blocked, cut and stained in crystal violet, after alcohol-chloroform or butyl alcohol series and can also be studied by the rapid method of squashing in a drop of propiono carmine.

The advantages of this technique are that osmium blackening is removed immediately after fixation, simultaneously rendering the material suitable for squashing; and staining is

normal both with carmine and crystal violet. The preparations obtained by the above method shows slender chromosomes, an important feature of the osmic fixed materials. Lastly, the usual acid hydrolysis is avoided as the oxalate helps to soften the root tips, making it suitable for squashes.

Central Rice Res. Inst., H. K. SHAMA RAO.  
Cuttack-4 (Orissa),  
January 31, 1956.

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### TREATMENT OF IRON CHLOROSIS IN YOUNG PEAR TREES

DURING an investigation on chlorosis of young Le Conte pear trees grown in the nursery, a selected solution containing iron and manganese (1% manganese sulphate, 0.5% ferrous sulphate, 0.1% drest soap) was the most effective spray for curing such nutritional disorder. It was thought advisable to apply such a treatment on a large scale. Thus an experiment was designed at the nursery of the Faculty of Agriculture, Giza, using several chlorotic Le Conte plants grafted on *P. calleryana*. Serious chlorosis appeared on such plants at the beginning of April, especially on the top leaves. Spray treatments were started on April 24th and continued till September 25th. The plants of the present experiment were grouped as follows:

**Group A.**—Those plants were sprayed with the solution at monthly intervals.

**Group B.**—Those plants were sprayed with the solution once every other month.

**Group C.**—Those plants were left without any spray (control). Such latter plants included both green and chlorotic plants.

Each treatment included 150 plants. Leaf samples taken from the fully expanded top leaves were collected fortnightly from each

TABLE I

Group	Dry wt./leaf mg.	Ash %	Mn p.p.m.	Fe p.p.m.
Group A plants	251	5.7	35	98
Group B plants	261	5.9	39	107
Group C Green plants	259	6.1	39	112
Group C Chlorotic plants	137	8.0	23	155

group of plants for the determination of dry weight per leaf, ash percentage, manganese and iron content. Results are summarized in Table I.

There were marked differences between untreated green and chlorotic leaves. Chlorosis markedly reduced the dry weight and manganese content of leaves while increased the ash and iron content of chlorotic leaves. As regards the chlorotic plants sprayed with 1%  $MnSO_4$ , 0.5%  $FeSO_4$ , 0.1% draft soap solution, there was a decisive recovery of all the sprayed plants within 6 days. Such plants regained their growth activity and the newly developed leaves were green and healthy. No doubt there was an increase in the dry weight of leaves of the treated plants. Such leaves can be compared favourably with those normal green leaves as regards their dry weight, ash, manganese and iron content. There was no difference, however, between the leaves of plants sprayed with solution once every month or every other month.

Thus it may be concluded that spraying the chlorotic young pear trees with such solution has proved to give highly satisfactory results. Such successful results were obtained whether the plants were sprayed with this solution at the rate of one spray each month or each other month. The recovered plants were much similar to those normally green ones.

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### EFFECT OF EXTIRPATION OF NEUROSECRETORY CELLS ON THE METAMORPHOSIS OF *IPHITA LIMBATA* STAL.

THE role of the neurosecretory cells of the brain in inducing moulting, growth and metamorphosis has been studied fully in *Rhodnius* by Wigglesworth.<sup>1</sup> He demonstrated that implantation of portions of brain containing the neurosecretory cells from nymphs one week after feeding, i.e., just around the "critical period" into the abdomen of nymphs decapitated soon after feeding, causes them to moult. Subsequently he<sup>2</sup> pointed out that the thoracic glands undergo cyclical development under the influence of the brain, which is responsible for

the moulting in the insect. Similar relationship between brain cells and the thoracic glands or their homologues have been recorded by Williams<sup>3</sup> in diapausing *Platysamia*, by Rahm<sup>4</sup> in *Sialis* and by Possompes<sup>5</sup> in *Calliphora*.

While studying the physiology of the neurosecretory cells of *Iphita limbata* Stal. (Phyrrhcoridae: Hemiptera) experiments were done to elucidate their function in the last nymphal instar. The neurosecretory cells of this insect form very conspicuous, paired clusters on the pars intercerebralis of the brain.<sup>6</sup> Newly moulted last instar nymphs show slender abdomen with a circumference of approximately 12 mm. to 14 mm. After a few hours they feed and gradually the abdomen swells up. From ten to twelve days it measures about 20 mm. to 24 mm. in circumference. Soon the nymph moults into the imaginal instar. In experimental studies, the neurosecretory cells of the pars intercerebralis were carefully extirpated from (1) nymphs after a full meal of plant sap, with abdominal circumference of 12 mm. to 17 mm., (2) nymphs with abdominal circumference of 20 mm. to 22 mm. and four to six days after feeding. Transplantations of three pairs of clusters of neurosecretory cells of the late nymphs (16 mm. to 21 mm.) into the early nymphs deprived of their neurosecretory cells a few days earlier, were also done. The operated insects were rather inactive and sluggish and were reluctant to feed.

Nymphs with slender abdomen with their neurosecretory cells removed, failed to develop the imaginal characters, though some of them survived the operation for about sixteen days. But when neurosecretory cells from late nymphs were implanted into the thorax of such insects, they promptly showed the development of the imaginal bodywall. However, they failed to moult completely and emerge out probably due to some physiological weakness. Also nymphs, five or six days after full feed and with swollen abdomen, did not fail to metamorphose into the imaginal instar in spite of the removal of their neurosecretory cells.

The above findings prove that the neurosecretory cells of the pars intercerebralis of the brain of *Iphita* have an important role to play in the activation and moulting in metamorphosis. It is conditioned by stimuli after a full meal. When extirpation is done early enough it brings about failure of moulting and metamorphosis; if done later the neurosecretory

cells have already initiated the moulting cycle and so moulting occurs.

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#### A NEW CESTODE *SENGA LUCKNOW-ENSIS* FROM *MASTACEMBELLUS ARMATUS* LACEP.

DURING an examination of about two dozen specimens of the Indian fresh-water fish, *Mastacembellus armatus* Lacep., three complete cestodes and two incomplete strobilae were obtained from the intestine of two of these fishes. These, on examination, appeared to represent a new species of the genus *Senga* Dollfus, 1934.

*Senga lucknowensis* N.SP.—The length of the three complete specimens vary from 210 to 212 mm. The scolex is pear-shaped, narrow anteriorly and broad posteriorly. It bears a pair of fleshy bothria terminating anteriorly in a disc which is notched on two sides. The disc bears two half crowns of hooks which vary in size. The sizes of the scoleses, the number of hooks, and their measurements are given in Table I.

TABLE I

Length of scolex mm.	Length of bothria mm.	Number of hooks	Size of the hooks	
			Large	Small
1.95	1.25	39	69 × 12 μ	40 × 7 μ
1.85	1.06	48	79 × 12 μ	35 × 7.5 μ
1.24	0.86	47	75 × 15 μ	20 × 4.5 μ
1.24	1.00	46	65 × 15 μ	27 × 6 μ
1.82	1.16	36	80 × 6.5 μ	50 × 5 μ

A distinct neck is absent. Some of the anterior immature segments are more or less square measuring 0.61 × 0.78 mm., while the mature and gravid segments of the middle and the posterior regions are much wider than long measuring 0.39 × 1.27 mm. The genital organs appear to develop in segments 25 mm. behind the head. In the region of the mature segments the successive segments are not well demarcated, so that there is often no true correspondence between the proglottides and the



genital sets. Certain proglottides may, therefore, seem to be apparently containing partly

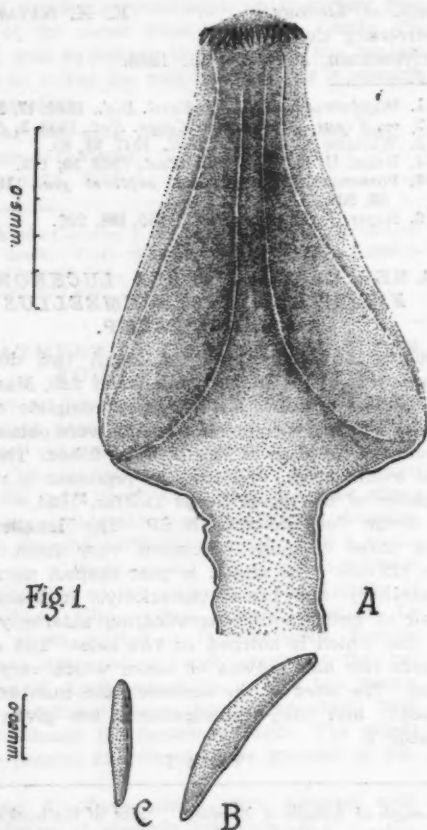


FIG. 1. A. Scolex of *Senga bucknovensis*. B. Large hook. C. Small hook.

or wholly some portion of the next genital set. But, in the region of the gravid segments, the

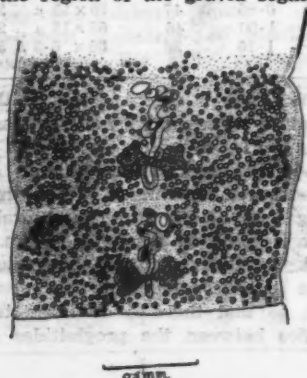


FIG. 2. Mature segment.

outlines separating the proglottides are fairly well de-lineated. In the mature segments the testes are numerous and around the ovary, located in the medullary region of the strobila, and measure  $40 \times 43-46 \mu$ . The cirrus sac is not clearly seen in whole mounts but in transverse sections it appears as a highly muscular structure with a coiled cirrus. The cirro-vaginal opening is situated anterior to the ovary on the dorsal side in the median line. The ovary is a bi-lobed structure situated in the hinder region of the proglottid.<sup>1</sup> The lobes measure  $150-190 \mu \times 100-113 \mu$  each, and are about apart, connected by a narrow isthmus. The uterus is anterior to the ovary and it winds anteriorly in a very irregular fashion making about 7-10 turns. Eventually it dilates into a large uterine sac measuring  $200-230 \mu$  in diameter, opens ventrally either to the right or to the left of the median line. In the gravid segments the uterine coils are not distinct due to



FIG. 3. Transverse section of a mature segment.

the large number of eggs contained in them. The vitelline follicles are situated in groups in the cortical parenchyma. Their continuity is interrupted on the mid-dorsal and mid-ventral lines. The two excretory canals are visible on each side of the proglottides in transverse sections and they are almost of the same diameter. The eggs are oval, thin-shelled and without opercula. They measure  $46-60 \mu \times 24-28 \mu$ .

The genus *Senga* Dollfus,<sup>1</sup> includes three species, *S. besnardi* Dollfus,<sup>1</sup> from France, *S. ophioccephaliana* Tseng,<sup>2</sup> from China and *S. pycnomeris* Woodland,<sup>3</sup> from India. The present form can be distinguished from *S. pycnomeris* mainly by the fewer number of hooks on the bothria, by the greater number of testes and also by the smaller size of its mature segments. From *S. besnardi* the present form differs in having larger hooks on the bothria, a bi-lobed ovary and also in having its vitellaria interrupted along the mid-dorsal and mid-ventral lines of the segments. The present form differs from *S. ophioccephaliana* in the smaller size of its hooks and testes, larger size of its uterine sac and also in the location of the vitellaria. Moreover, the present form appears to be much larger in size than the other known species



Hence it is regarded as a distinct species and named *Senga lucknowensis* n. sp.

The author is highly thankful to Prof. M. B. Lal for his guidance.

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# ANATOMY OF THE DIGESTIVE SYSTEM OF INDIAN MANTIS Sp.

A DETAILED study of the digestive system in a number of species of Orthoptera was made by L. Bordas as early as 1898, but very little information is available on the Mantidae of India. The author's observations on these are recorded below.

In *Mantis* Sp., the alimentary canal consists of oesophagus, crop, gizzard, mesenteron and hindgut. The oesophagus extends upto mesothorax followed by the crop. On either side of the oesophagus lie a pair of salivary glands. Each gland is made up of a number of spherical lobules resembling a bunch of grapes. The glands are traversed throughout by a network of fine branches of tracheae and canaliculi. The canaliculi join to form a salivary duct on each side and open anteriorly into buccal cavity. One of the lobes of the salivary gland on each side is very much reduced in size. In between the two glands lies a small, vesicular salivary receptacle, communicating with a pair of salivary receptacular ducts, joining the common salivary duct in front.

The crop is thin-walled and pyriform in shape, extending from metathorax to three-fourths the length of the abdomen, serving as a reservoir of food. The gizzard is pear-shaped, rudimentary and followed by eight enteric caecae. The enteric caecae are finger-shaped and open into the alimentary canal just behind the gizzard. The gizzard is internally lined by a number of chitin ridges. Perhaps due to carnivorous diet of the animal, the gizzard has been secondarily reduced in size and importance.

The gizzard is followed by mesenteron, a short, coiled tube of uniform diameter, internally lined by glandular epithelium. The peritrophic membrane is present.

The mesenteron is followed by hindgut and at the junction of the two, a large number of

hair-like malpighian tubules open into the alimentary canal. The hindgut is short, followed by an oval rectum, with a number of rectal papillae.

The long and extensive foregut with a capacious crop, a rudimentary gizzard, a short mesenteron and hindgut, with well-developed salivary glands and enteric caecae of *Mantis* Sp. is well adapted for the carnivorous diet of the predatory animal. In phytophagous insects we find a well-developed gizzard and a longer mesenteron as in Tettigonidae and Agerididae. These observations are in agreement with that of Bordas.<sup>1</sup> Study of the histology of the digestive tube of *Mantis* Sp. is in progress, and a more detailed paper will appear shortly.

Dept. of Biology,  
J. S. S. College, Dharwar,  
March 23, 1956.

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# AN INTERSPECIFIC HYBRID OF GRAIN SORGHUM AND JOHNSON GRASS—*S. halepense* ( $2n=20$ ) $\times$ *S. roxburghii* ( $2n=20$ )

Two chromosomal forms, viz.,  $2n=20$  and 40 have been reported from the Indian species of *S. halepense*.<sup>1,2</sup> The 20-chromosomed *halepense* is found to behave as a normal diploid in its meiosis.<sup>2</sup> Hybrids between *S. halepense* ( $2n=40$ ) and grain sorghums ( $2n=20$ ) have been reported by several workers.<sup>3</sup> A hybrid between the 20-chromosomed form and grain sorghum is reported here for the first time.

Fig. 1 shows the parents and the hybrid. A



FIG. 1. (a) *S. halepense* ( $2n=20$ ) (1/40 Nat. Size); (b) *S. roxburghii* var. *hians* ( $\times 1/55$ ); (c) Hybrid plant ( $\times 1/75$ ).

TABLE I

Characteristic	<i>S. halepense</i>	<i>S. roxburghii</i>	F <sub>1</sub> plant
Chromosome number (2n)	20	20	20
Plant height (cm.)	250	349	392
Stem thickness (diam. in cm.)	0.9	1.6	1.5
Number of tillers	30	0-1	20
Leaf length (cm.)	85	58	94.6
" breadth (cm.)	3.5	8	5.5
" margin	straight	wavy	slight wavy
Length of stomata ( $\mu$ )	31.8	36.9	33.2
Panicle and axis	loose, thin	loose, thick	loose, intermediate
Spikelets	elliptic	ovate	ovate
" drying colour	straw	bleached	straw
" size	small	large	intermediate
Awns	nil	nil	short awns
Hairiness	hairy	glabrous	hairy
Grain shape	elliptic-obovate	ovate-rotundate	ovate-elliptic-ovate
" size and exposure	small, enclosed	large, fully exposed	intermediate, half exposed
" colour	brown	white pearly	brown
" shedding	shedding	non-shedding	intermediate

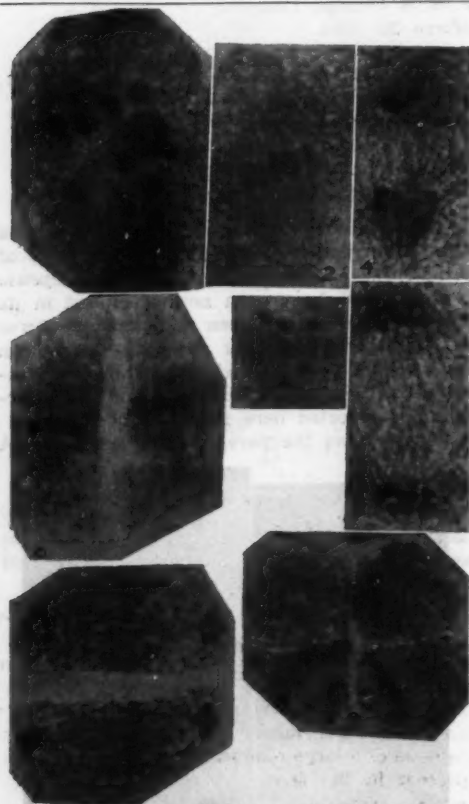


FIG. 2.—1. Diakinesis showing ten bivalents. 2. Metaphase-I side view. 3. Polar view of the same; one bivalent at ten o'clock position out of focus. 4. Anaphase-I. 5. Telophase-I showing ten daughter-bivalents at each pole. 6 and 7. Second meta and telophases. 8. Tetrad. (All microphotographs,  $\times 1,150$ .)

comparative statement of the important characteristics of the plants is given in Table I.

From Table I it is seen that the F<sub>1</sub> transgresses the parents in some characters, intermediate in others and in a few cases like the wild parent.

The meiosis of the hybrid is normal, giving ten bivalents at diakinesis, a normal bipolar spindle and congression at Metaphase-I. The anaphase shows ten daughter-bivalents separating and migrating to the poles. The second division also is typical giving well-formed tetrads (Fig. 2—1 to 8). The pollen is normal and 35.8% sterile.

The haploid of the grain sorghums has been observed to form 1 to 3 bivalents.<sup>4,5,6</sup> This would point to the probable duplication of chromosomes in the genome of the grain sorghum ( $2n=20$ ). The hybrid between the tetraploid *halepense* and the diploid grain sorghum is a 30-chromosomed plant in accordance with crosses involving parents with numerical differences in the genomes. The hybrid forms 3 to 6 trivalents indicating the probability of the 40-*halepense* being an allotetraploid. Based on the observations on a 20-chromosomed polyploid Duara and Stebbins<sup>7</sup> consider *S. halepense* ( $2n=40$ ) to be a segmental allopolyploid. The pairing in the present hybrid shows a complete homology between the genomes of the two parents. It may be assumed that the 20-chromosomed form is a genetical diploid of the 40-*halepense*. Thus the evidence seems to point more towards the autoallopolyploid nature of the 40-*halepense*. Otherwise the grain sorghum should also be segmental allopolyploid.

Snowden<sup>8</sup> has classified the subsection *Halepensis* of section *Eu-sorghum* into four spe-

cies, viz., (i) *halepensis*, (ii) *miliaceum*, (iii) *controversum*, and (iv) *propinquum*. According to his grouping, most of the Indian *halepense* plants fall under the last three, the species *miliaceum* and *controversum* having a wider distribution and *propinquum* being restricted to the south-east coast of India. So far only the species *halepensis* Snowden<sup>8</sup> has been utilized in these interspecific hybridizations. The present hybrid is between species *miliaceum*, Snowden<sup>8</sup> and grain sorghum.

A number of crosses back to the grain sorghum have been done in order to obtain good fodder and grain sorghum. A detailed account of the behaviour of the hybrid will be reported elsewhere.

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# A NEW SPECIES OF EIMERIA FROM A COW-CALF IN BOMBAY STATE

DURING the course of an earlier investigation into the coccidial fauna of domestic animals in Bombay State, Rao and Hiregaudar<sup>1</sup> recorded *Eimeria zurnii*, *E. bovis* (smithi), *E. cylindrica*, *E. bombayensis* and *E. khurodensis* as the causal agents of coccidiosis in cattle. Of these, the first four are common and pathogenic while the last one is of rare occurrence and not so pathogenic.

Recently, the present author came across an unknown species of *Eimeria* in a fecal sample sent by the Veterinary Officer, Mundaragi (Dist. Dharwar). On account of some of the distinguishing features the oocysts of *Eimeria* from Mundaragi are considered as new to science and are described here under the name of *E. mundaragi*. The fecal sample containing

the oocysts of *E. mundaragi* has been deposited in the parasitological laboratory of Bombay Veterinary College.

*Eimeria mundaragi* sp.—Oocyst oval or egg-shaped (Fig. 1) with one end slightly



FIG. 1

pointed than the other and measures 36-38 × 25-28 μ. Wall of the oocyst thin, smooth, transparent, pale yellow or yellow in colour and slightly thicker towards the micropyle end. Thickness of the wall of the oocyst 0.3 × 0.4 μ. Micropyle distinct, 0.5 μ at the base and without a polar cap. Sporont 15-20 μ along the greatest diameter and finely granular in consistency. Sporocysts oval, 14.8 × 9.1 μ with a thinning at the pointed end. Sporozoites 4-6 × 1-3 μ and finely granular. Sporocystic residuum present. Oocystic residuum absent. Sporulation time 24-48 hours during summer.

*E. mundaragi* resembles *E. wyoningensis* in shape and size but differs from it in the colour of the wall of the oocyst which is pale yellow or yellow instead of yellowish or greenish brown and the sporulation time 24-48 hours instead of 120-168 hours. It also differs from *E. bombayensis* in possessing an egg-shaped oocyst instead of ellipsoidal or cylindrical and the wall of the oocyst thin, pale yellow or yellow instead of thick and pale yellowish brown.

As regards the pathogenicity of *E. mundaragi*, it is not possible to say anything unless it occurs in a pure form. The cow-calf from which the oocysts of the *E. mundaragi* were obtained had a mixed infection with *E. zurnii* and manifested severe dysenteric conditions and emaciation due to infection with the latter because of a large number of oocysts of *E. zurnii* present in the feces.

Bombay Veterinary College, L. S. HIREGAUDAR.  
Bombay, April 2, 1956.

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### THE DEVELOPMENT OF ENDOSPERM IN *SCILLA INDICA* BAKER

THE development of endosperm in the so far investigated species of *Scilla*, one of the extremely interesting genera of Liliaceae, is recorded to be of the nuclear type.

After fertilization the embryo sac with the broad basal part is enclosed by the nucellar remains, the inner and outer integuments. The strong vascular supply of the ovule extends to the densely

nucleate chambers soon become binucleate after a nuclear division (Fig. 4). The two nuclei of the chalazal chamber do not undergo further divisions but become highly enlarged (Figs. 5-6) and often acquire an irregular shape (Fig. 7). This chamber with its dense vacuolate cytoplasm gradually extends towards the chalaza by crushing most of the cells (Figs. 5-6). Meanwhile the two nuclei of the micropylar chamber undergo repeated free nuclear divisions giving rise to a large num-

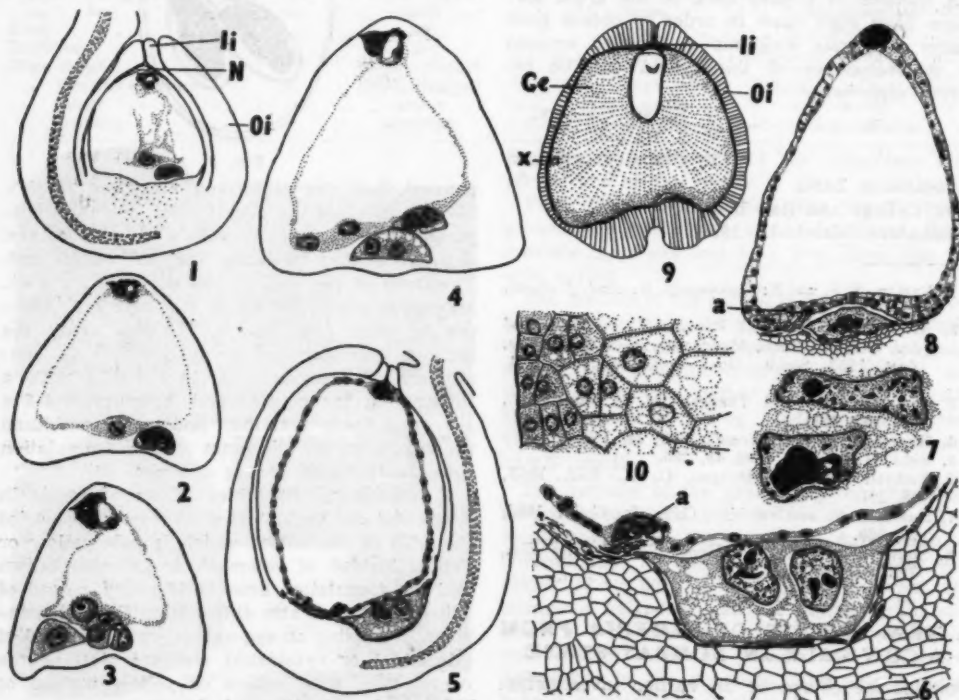


FIG. 1. L.s. ovule with embryo sac after fertilization,  $\times 49$ . FIGS. 2-3. First division of primary endosperm nucleus,  $\times 157$ . FIG. 4. Binucleate chalazal and micropylar chambers of the embryo sac,  $\times 157$ . FIG. 5. L.s. ovule,  $\times 47$ . Note the binucleate chalazal and multinucleate micropylar chambers of the embryo sac. FIG. 6. The chalazal chamber with surrounding parts of Fig. 5 enlarged,  $\times 151$ . Note the persisting antipodal cells. FIG. 7. Two nuclei of the chalazal chamber showing irregular shape,  $\times 483$ . FIG. 8. Cell wall formation in the micropylar chamber,  $\times 34$ . Note the degenerating chalazal chamber. FIG. 9. L.s. fairly old seed,  $\times 10$ . FIG. 10. A portion of endosperm at the mark  $\times$  in Fig. 9 enlarged,  $\times 200$ . (a, antipodal cells; Cs, cellular endosperm; li, inner integument; N, nucellar remains; Oi, outer integument.)

cytoplasmic chalazal part. The primary endosperm nucleus is situated near the antipodal cells in the basal region (Fig. 1). Its first division is followed by a cell wall and the embryo sac, consequently, becomes divided into a small chalazal chamber and a very large micropylar chamber (Figs. 2-3). Both the uni-

ber of nuclei which remain embedded in a thin layer of cytoplasm at the periphery of the embryo sac (Fig. 5). Soon this is followed by a simultaneous cell wall formation (Fig. 8). The subsequent growth of endosperm is centripetal and the large central cavity of the embryo sac gradually becomes filled with the

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endosperm tissue (Fig. 9). The peripheral cells of the endosperm are small with dense cytoplasm compared with the cells of the central region (Fig. 10).

As cell walls are laid down in the micropylar chamber, the activity of the chalazal chamber gradually declines and finally the chamber degenerates. During the development of endosperm, the embryo sac enlarges enormously, crushing the entire nucellus and the inner integument except an insignificant portion at the micropylar region (Fig. 9). The antipodal cells take deep stain and are persistent (Figs. 6 and 8).

The mode of endosperm development in *Scilla indica* is, therefore, not nuclear as in the other investigated species but Helobial. A careful investigation of the development of endosperm of the uninvestigated species of *Scilla* coupled with other embryological data may throw further light on the grouping of genera in the subfamily Scilloideae.

It gives me great pleasure to record my gratitude to Professors K. N. Narayan and S. B. Kausik for their encouragement and guidance during the course of this investigation. I am highly thankful to Dr. M. S. Chennaveeriah for having collected the material for me near Bombay.

Dept. of Botany, D. A. GOVINDAPPA.  
Central College, Bangalore-1,  
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# IMMUNISATION OF CATTLE AGAINST FOOT AND MOUTH DISEASE WITH CRYSTAL VIOLET VACCINE

As early as 1938 Waldmann's method<sup>1</sup> of vaccination against Foot and Mouth Disease—a modification of Schmidt's original method<sup>2</sup> was extensively used in Germany. It consisted in treating the Foot and Mouth Disease virus and epithelium recovered from the tongue of cattle with aluminium hydroxide and formalin, thereby rendering the virus innocuous. This aluminium hydroxide "adsorbed" vaccine is also being used in other countries of Europe. The duration of immunity is reported to be for 6-8 months. Besides, other modifications have been

tried using crystal violet, chloroform, etc. Graub<sup>3</sup> made the first experiment using crystal violet dye in the preparation of the vaccine.

Under the auspices of the Indian Council of Agricultural Research, a research scheme is working at the Indian Veterinary Research Institute, Mukteswar, with the object of devising a suitable method of vaccination for the control of Foot and Mouth Disease among cattle in India. This is a disease of much economic importance as the losses due to reduced working capacity, diminished milk yield, deaths of affected animals, etc., amount to about 4 crores of rupees annually. A complicating and rather difficult factor to be reckoned with in the control of the disease is that there are three different types of virus, O, A and C, which are immunologically distinct and so a vaccine should be a polyvalent one containing the three types for general prophylactic measure. However, a mono- or a bivalent vaccine can with advantage be used in conducting preventive vaccination against any, one or two types respectively. This note gives a preliminary account of the preparation of and the successful immunisation of animals with crystal violet vaccine evolved at this Institute.

The polyvalent vaccine is prepared by reinforcing the blood, drawn at the height of thermal reaction from the reacting hill-bulls with 7.5% suspension of tongue epithelium, 2.5% suspension of each type of virus. The epithelium along with the lymph of vesicles on the tongue is collected aseptically from the bulls inoculated with a bovine strain of the virus. The material is weighed and then cut into very small pieces and triturated in a mortar. Sufficient quantity of buffer phosphate, pH 7.6, is added so as to enable centrifuging it for the removal of tissue particles. The blood collected from the hill-bull is incorporated. Finally crystal violet solution, sterilized at 60° C. for half-an-hour, is added in the concentration of 0.03%. The vaccine is now incubated at 37° C. for 10 days. Later, it is tested for purity, safety and potency. The dose for adult cattle is 30-40 c.c. given subcutaneously.

Experimental vaccination of animals both in the laboratory as well as in the field was carried out to assess the value of the vaccine. 24 Buffalo-calves were vaccinated with the crystal violet vaccine monovalent type 'O' at Military Farm, Bareilly. They were tested for immunity in batches of six animals each after



an interval of four, eight, thirteen and seventeen months. The animals remained solidly immune up to 13 months while two animals out of the last batch tested 17 months after vaccination reacted mildly on challenging them with Foot and Mouth Disease Virus type 'O'. The control animals showed quite a severe reaction in all the tests. From the observations there is evidence of adequate immunity for about 17 months.

With a view to ascertain the comparative value of crystal violet vaccine (Mukteswar) and the 'gel' vaccine bivalent types O and A (Copenhagen) a consignment of the latter was obtained from State Serum Institute, Copenhagen. Four hill-bulls, four sheep and four goats were inoculated with 32 c.c. and 15 c.c. each respectively and were tested for immunity 36 days after they were vaccinated. One of the hill-bulls, two goats and one sheep reacted severely. It is quite evident from the above observations that the immunity conferred by this vaccine was of shorter duration than that of crystal violet vaccine.

It has been found that crystal violet vaccine is simpler to prepare and is as efficacious as the "adsorbed" vaccine. There is experimental evidence indicating that the duration of immunity also is longer. Further work is in progress and efforts are being made for wider application of the vaccine in the field.

Div. of Pathology and V. R. GOPALAKRISHNAN.  
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### THE INTENSITY OF RAMAN LINES IN SPECTRA OF SOLUTIONS OF PYRIDINE IN ACETIC ACID

IN his recent papers Lakshmanan<sup>1</sup> published the results of his study on the Raman spectra of pyridine solutions in fatty acids. He notices some displacements of the Raman lines of pyridine and also the appearance of a new line 1006  $\text{cm}^{-1}$ . According to Lakshmanan, the intensity of the new line reaches a maximum for a solution containing 20 mol. % of pyridine and 80 mol. % of acid.

Similar studies have been made in our laboratory. We have observed similar changes in the spectrum of pyridine, and particularly, the

appearance of a new line of frequency 1003-1007  $\text{cm}^{-1}$ , the exact frequency depending on the concentration of the solution.<sup>2,3</sup> This line was considered to be due to modified totally symmetric oscillations of a ring of pyridine molecules which form complexes with molecules of acetic acid. Attention was therefore directed to the pyridine solutions of acetic acid. We have examined the spectra of 13 solutions of different concentrations and have measured the frequency of Raman lines as well as the intensity of the new line 1003  $\text{cm}^{-1}$ .

For this purpose the spectra of all solutions were photographed on the same plate at the same conditions. Photometric graphs were then taken by means of a recording Moll-microphotometer. To measure the intensity of the 1003  $\text{cm}^{-1}$  line for that part of the spectrum between about 985 and 1035  $\text{cm}^{-1}$  the density contour was transformed into intensity contour by means of characteristic curves drawn for each plate. Some of these contours

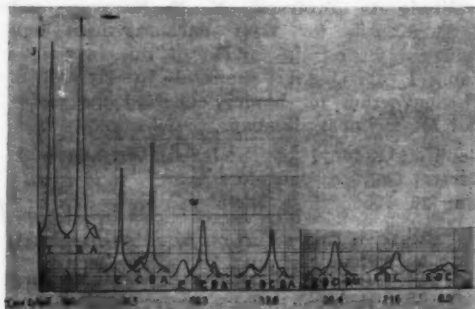


FIG. 1

are shown in Fig. 1. The intensity contours were carefully analysed and component lines separated. The latter are marked on Fig. 1 by dashed lines. The lines of pyridine e-989 and e-1029  $\text{cm}^{-1}$  are indicated by letters B and E respectively, the line marked by letter A is a f-1029 line. The new line of frequency 1003-1007  $\text{cm}^{-1}$  is marked everywhere by the letter C.

The intensity of this line was measured by integrating the area of this line. The results of measurements made on three series of spectra are represented by points on Fig. 2. The line drawn through these points represent the intensity as a function of the molar concentration of pyridine. In spite of the fact that the experimental errors are as high as 25%, it may be easily seen that the intensity for equimolecular solution takes on its maximum value.

During analysis of the spectrum of this solution, the  $989\text{ cm}^{-1}$  line was also discovered. From this it may be concluded that in such a solution, in addition to the pyridine molecules which form complexes, there are a number of free pyridine molecules.

The rough assumption is made that the scattering cross-sections of all the pyridine molecules forming complexes do not depend on the solution concentration. Considering that according to the law of mass action, the largest number of such pyridine molecules occurs for a solution in which the ratio of the number of pyridine molecules to the number of acetic acid molecules is the same as in the complex, it is concluded that the complex formed in the solutions investigated contains one molecule of pyridine and one of acetic acid.

The value of the ratio of intensity of the new line to the molar concentration of pyridine has no physical sense for the solutions containing more than 40 mol. % of pyridine, for, as we have seen, in such solutions complexes are not formed by all pyridine molecules present. In more dilute solutions, the value of this ratio decreases somewhat, but this decrease lies within the experimental error. Thus the assumption that the scattering cross-section remains constant for pyridine molecules forming complexes seems to be justified.

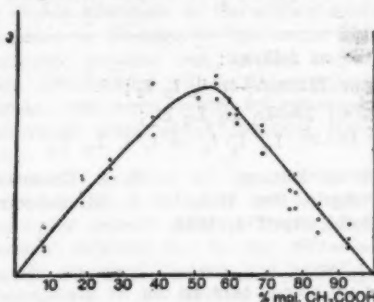


FIG. 2

In Fig. 1 for more dilute solutions, a line D of frequency near  $1020\text{ cm}^{-1}$  is also seen. So far, the existence of this line has not been explained. Kohlrausch<sup>4</sup> reported the existence of a very weak line of acetic acid of frequency  $1020\text{ cm}^{-1}$ . Under our working conditions this line has not been observed in spectra of pure acetic acid. It does not seem probable however that the line observed is a reinforced line of acetic acid. On the other hand, this line may constitute another modification of the  $989\text{ cm}^{-1}$  pyridine line. Formic acid has no line in this region, but in the spectra of solu-

tions of pyridine in formic acid containing 10 and 5 mol. % of pyridine, we have found lines of frequencies  $1022$  and  $1025\text{ cm}^{-1}$  respectively, in agreement with Lakshmanan's results. It is still an open question whether these lines have an analogue in the line  $1020\text{ cm}^{-1}$  observed in spectra of acetic acid solutions of pyridine, or whether they have to be identified as a displaced line of pure pyridine  $1029\text{ cm}^{-1}$ .

On the basis of the dependency of several physico-chemical constants on the concentration, Lakshmanan assumes that there are complexes built of one molecule of pyridine and four molecules of acid in solutions of pyridine and fatty acids. Lakshmanan's experimental results that the line  $1006\text{ cm}^{-1}$  has a maximum intensity in solutions containing 20 mol. % of pyridine seems to confirm his conclusions. These conclusions do not agree with those arrived at on the basis of the measurements presented in this paper.

Had there been a complex of the kind assumed by Lakshmanan and had it been manifested by a new line in the spectrum, it should have been the D line in Fig. 1, rather than that of  $1006\text{ cm}^{-1}$  frequency.

The author would like to thank Professor J. Pniewski for his interest in this work and his many valuable suggestions.

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## A CASE OF PLEIOTROPY IN PIGEON PEA

SINGH, BANSAL AND MITAL<sup>1</sup> recorded in pigeon pea [*Cajanus cajan* (L.) Millsp.] a new variant to which they gave a specific rank and designated it as *Cajanus obcordifolia* Singh. The variant possessed obcordate leaflets with mucronate apex and the petals constituting the keel of the flower were free and filiform. Normally the leaflets in pigeon pea are lanceolate, with acuminate apex and the petals forming the keel are joined together and are not filiform.

Inheritance studies, since conducted by the present authors, have shown that the variant described by Singh et al. yields fully fertile

hybrids when crossed with pigeon pea types having normal leaflets. In the several  $F_2$  progenies studied the ratios of "normal" to "obcordate" plants were observed to be 15:1 and 3:1, indicating the operation of a pair of duplicate genes. In respect of all the other plant characters, the variant behaves like any other variety of *Cajanus cajan*. There thus seems to be no reason to elevate it to a specific rank. *Cajanus obcordifolia* Singh may therefore be reduced to a synonym of *Cajanus cajan* (L.) Millsp. The variant is locally be-

crosses had lanceolate leaves, with acuminate apex, and non-filamentous keel.

It would thus appear that the characters, obcordate leaflets and filiform keel, were very closely associated in the segregants also. In the extensive segregating populations studied during the course of several years, no recombinations were noticed. This suggests that each of the pair of duplicate genes,  $I_1$  and  $L_2$ , etc., governing the mutant character is pleiotropic in effect. On the basis of the above results the genetic constitution of the parental strains

TABLE I

Cross	Generation	Leaflets: Lanceolate Apex: Acuminate		Leaflets: Obcordate Apex: Mucronate		Total number of individuals	Expected ratio	P value
		Keel non-filamentous	Keel filamentous	Keel non-filamentous	Keel filamentous			
Kanpur Mutant $\times$ N.P. (C) 15	$F_2$	133	..	..	12	144	15:1	0.50 & 0.20
N.P. (C) 15 $\times$ Kanpur mutant	$F_2$	116	..	..	8	124	15:1	0.95 & 0.99
Kanpur mutant $\times$ N.P. 41	$F_2$	287	..	..	84	371	3:1	0.50 & 0.20
N.P. 41 $\times$ Kanpur mutant	$F_2$	115	..	..	34	149	3:1	0.80 & 0.50
[Kanpur mutant $\times$ N.P. (C) 15] $\times$ Kanpur mutant	B. C. 1	84	..	..	26	110	3:1	0.80 & 0.50
(Kanpur Mutant $\times$ N.P. 41) $\times$ Kanpur mutant	B. C. 1	70	..	..	65	135	1:1	0.70 & 0.50

ing designated as the "Kanpur mutant" as it was first located at Kanpur by Singh *et al.*

It was noticed during these inheritance studies that the obcordate type of leaflet was invariably associated with the filiform keel characteristic of the Kanpur mutant. Observations with regard to these characters, in the  $F_2$  and back-cross generations of crosses of the Kanpur mutant with other pigeon pea types, viz., N.P. 41 and N.P. (C) 15, are presented in the following table; the  $F_1$  plants of these

would be as follows:

Kanpur Mutant— $I_1 I_2 L_2 L_2$ ;

N.P. (C) 15— $L_1 L_1 L_2 L_2$ ;

N.P. 41— $L_1 L_1 L_2 L_2$  or  $I_1 I_1 L_2 L_2$ .

Division of Botany, R. B. DESHPANDE.  
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#### DR. K. S. KRISHNAN

DR. K. S. KRISHNAN, Director, National Physical Laboratory, New Delhi, has been elected a foreign associate of the National Academy of Sciences, U.S.A., in appreciation of his services to science. The number of

foreign associates, elected to the Academy, is restricted to about 50. Dr. Krishnan has the unique distinction of being the first Indian to receive this honour.

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## REVIEWS

**Humidity.** By H. L. Penman. (Published by the Institute of Physics, London, S.W. 1), 1955. Pp. 71. Price 5 sh.

Thirty-five years ago the Physical Society of London arranged for a 'Discussion' on hygrometry and published the results in a pamphlet. The principal methods used in the measurement of humidity were therein described and the discussions contained several matters of intricate detail. In an introductory article to it, Sir Napier Shaw, Director of the London Meteorological Office, wrote: "The conclusion at which I have arrived at is that the wet bulb is useless for temperatures just below freezing, and should be discarded. Descriptions of the endeavour to find a suitable formula abound in meteorological literature; but practically the subject has not advanced at all in my time".

It is therefore a matter of real satisfaction that the measurement of humidity in general, and the measurement of humidity at temperatures below the freezing point in particular, have made considerable advances in the last few years. A descriptive summary of the various methods of measuring humidity, incorporating these recent advances, is the subject-matter of the booklet by Penman in the useful series of monographs brought out by the Institute of Physics. The booklet will be found valuable by physicists and even more by meteorologists, the strongest point about it being the compactness.

Written for persons of the undergraduate-graduate level, it is naturally not so exhaustive on particular aspects as the Physical Society's 'Discussion' referred to. In the author's own words, the standard is what one would expect of a candidate to be selected as "a technical assistant to help in problems of atmospheric and soil humidity".

After giving an account of the nature of water vapour, and developing the theoretical aspects of water-vapour-air relation in two preliminary chapters, the methods of measuring humidity are described in five chapters under the heads: Measurement of absolute humidity; Dew point hygrometer in which is included the frost point hygrometer developed for use in aeroplanes by Dobson, Brewer and Cwilong; Wet and dry bulb hygrometer; the use of hygroscopic materials, which includes the hair and miscellaneous devices. A final chapter deals with the control of humidity.

The descriptions are clear but not exhaustive. Considering the importance of measurements of humidity in free air, some more details of the adaptations of the instruments for attachment to instruments used in atmospheric soundings would have been in place in the book.

In dealing with the wet bulb, the empirical work of Glaisher and the theoretical work of Normand could have been described with advantage. Glaisher's "factor" and Normand's theorems on the wet bulb form integral parts of the science of humidity (see for instance, articles on Humidity by Skinner and on Thermodynamics of the Atmosphere by Shaw in Vol. III of the *Dictionary of Applied Physics*).

On page 15, the author says: "If all the latent heat of vaporization has been supplied by the air, then this temperature  $T_w$  is known as the wet-bulb temperature". What is known as the wet-bulb temperature is the reading of a thermometer with wet muslin around its bulb. Such measured wet-bulb temperature should theoretically have the value  $T_w$ . It is therefore more appropriate to refer to  $T_w$  as the ideal wet-bulb temperature as distinct from the reading of a wet-bulb thermometer. In 1931 Normand suggested the name "saturation temperature" for this ideal wet-bulb temperature.

The above suggestions have been made with the idea that the author may consider them for a future edition. In the small space of 60 pages, the book contains a wealth of information, well presented and will greatly benefit the general scientist and the meteorologist.

K. P. RAMAKRISHNAN.

**Reduction with Complex Metal Hydrides.** By Norman G. Gaylord. (Interscience Publishers), 1956. Pp. 1046. Price \$15.

Lithium aluminium hydride (LAH), which was first used for the reduction of organic compounds only ten years ago, is now one of the most widely used reducing agents in organic chemistry, and an extensive literature on the application of LAH, sodium borohydride and other metal hydrides has accumulated. The present volume, which gives a very thorough coverage of the literature up to January 1953, is therefore an opportune publication. Entire papers on hydride reductions are few in comparison with the hundreds of papers which



deal *inter alia* with reactions involving the use of metal hydrides, and the author has carried out the stupendous task of a page by page examination of the leading journals and of *Chemical Abstracts*. Before proceeding to organic reductions with the hydrides the preparation and properties of complex metal hydrides are described. There are also chapters on inorganic reactions, reactions with organometallic compounds, and the use of complex metal hydrides for the determination of active hydrogen and for other analytical purposes. General considerations in the reduction of organic compounds with metal hydrides are then discussed. Ten chapters are devoted to a detailed account of the hydride reduction of organic compounds classified according to functional groups. For each group the products and yields from individual compounds are listed in tables accompanied by charts of structural formulae. A chapter is devoted to the behaviour of LAH towards carbon-carbon multiple bonds, and the complex data are summarized very clearly. A chapter on miscellaneous reactions gives an excellent account of hydrogenolysis by LAH and of Ziegler's recent and important work on the synthesis and applications of aluminium alkyls. Two particularly useful chapters describe the experimental conditions for hydride reactions in the laboratory and on a commercial scale, drawing attention to hazards and precautions to be taken.

The book appears to be produced by litho-printing from typescript, and the printing is in very clear type. The formulae are remarkably clear. For an American book of 1046 pages, the price is very reasonable.

This is a carefully documented, comprehensive and scholarly monograph, which will be invaluable to every organic chemist for study and reference.

K. V.

**Theoretical Principles of Organic Chemistry, Vol. I.** By W. Huckel. (Elsevier's, London and New York), 1955. Pp. xi + 904. Price 77 sh. 6 d.

This truly ponderous work is a translation from the 7th edition of the original in German. It is a detailed record, in chronological order, of the important contributions that have been made towards an understanding of the theoretical principles of organic chemistry. The discussions include stereochemistry, organic molecular and complex compounds, free radicals, tautomerism, intramolecular rearrange-

ments, Walden inversion, reactions of unsaturated and aromatic compounds and course of certain chemical reactions. In most of these discussions, a good deal of space is devoted to older view-points to the exclusion at several places of more recent developments. The discussions do not necessarily suffer on this account and may serve as reminders that all fundamental theoretical advances in organic chemistry have not been made within the last few years.

A serious drawback of the book concerns the style in which it is written. The translation from the original is much too literal with the result that several passages have to be read over and over again before the meaning becomes clear. Lengthy and complicated sentences occur a little too frequently and retard easy reading.

In spite of this handicap, the book is still stimulating and worth careful study. There is no doubt that one can profit from its wide and critical survey of theoretical organic chemistry.

S. SWAMINATHAN.

**Polymyxin, Neomycin, Bacitracin.** (Antibiotic Monographs No. 5). By Ernest Jawetz. Foreword by H. Welch and Felix Marti-Ibanez. (Medical Encyclopædia, Inc., New York.) Pp. 96. Price \$4.00.

This monograph presents material of value to the pathologist and the clinician about the three antibiotics, which though not as widely used as penicillin, streptomycin or the tetracyclines, are nevertheless of value in special cases. Under each antibiotic, an informative account is given of what needs to be known regarding the history, chemistry, antimicrobial activity, absorption and excretion, toxicity, clinical use, etc. The indications and contraindications have been particularly stressed and the coverage of matter is thorough. There is a useful bibliography listing 205 publications; of these, only 17 on polymyxin originates from Britain, the rest are from America.

The get-up of the monograph and the printing are undoubtedly attractive and the reviewer agrees fully with the editors that "this clear concise monograph thoroughly covers the subject-matter". He also recommends it to those who wish to know about the clinical usefulness of polymyxin, neomycin and bacitracin, but the price is clearly a little too high.

K. GANAPATHI.



Silver Jubilee Souvenir, 1955. (Society of Biological Chemists, India), 1955. Pp. xvi + 262.

The Silver Jubilee Souvenir of the Society of Biological Chemists, India, is an interesting volume containing contributions from eminent biochemists both in India and abroad. The subjects dealt with are varied and include: A Colorimetric Method of Assay and the Partial Purification of Beef Liver Esterase, The Biochemistry of Human Genetics, Visual Pigments, Ascorbic Acid and Hydrogen Peroxide in Metabolism, Biochemistry of the Labile Methyl Group, Hypothermia and Its Induction by Drugs, Diabetes as a Disturbance of Carbohydrate Metabolism, The Role of Nucleotides in the Biosynthesis of the Nucleic Acids, Biochemical Engineering, Deuterium Exchange between  $\beta$ -Lactoglobulin and Water, Alkaloids from the Leaves and Roots of *Rauwolfia canescens* L., etc. This makes the volume a brilliant record of some of the achievements in the field of biochemistry during recent years.

The fact that several biochemists from other countries have contributed to this volume, shows the goodwill which the Society of Biological Chemists enjoys in the international field. The Souvenir is a fitting memorial to the Silver Jubilee of the Society.

M. V. R.  
S. M. P.

Annual Report for 1954-55—Nutrition Research Laboratories. (Indian Council of Medical Research, Coonoor, S. India), 1955. Pp. 36.

The booklet under review gives in detail the work carried out by the Nutrition Research Laboratories, Coonoor, during the year 1954-55. The research work relates to studies on vitamins, proteins, fats and investigations carried out in the nutrition clinic and in the field as also on a research project connected with protein malnutrition. Further, the interrelationship between rice diet and fertility has also been studied. Among the important findings, special mention may perhaps be made of the development of a fluorimetric method for vitamin A determination, the unusual observation that a certain species of amaranthus known as 'Raj-keera' has a high content of lysine, the effective treatment of a number of cases of 'Kwashiorkar' with Bengalgram and Bengalgram-rice-calcium lactate diets and a study of the role of material malnutrition in 'Kwashiorkar' by clinical and biochemical findings in two hundred antenatal cases. Further, animal experiments with albino rats carried out under rigidly

controlled conditions have shown no difference in the fertility rate of animals maintained on 'rice diets' and 'wheat diets'. In regard to maintenance requirements of proteins in young adults, the report could have been more explicit, particularly in regard to the definition and calculation of biological value (B.V.), egg replacement value (E.R.V.) and negative nitrogen balance. However, the results obtained with five healthy young adults appear very interesting and should be confirmed by carrying out similar experiments on a larger number of persons. The report gives in the end a list of scientific meetings held, education and advisory work carried out and the titles of eighteen publications in *Indian Journal of Medical Research* and other scientific journals. One is indeed struck by the remarkable progress made in different fields of nutrition research during the period under review. It is to be hoped, that in the years to come, much more impressive and useful work will be carried out by this premier research institution devoted to a study of all aspects of nutrition research in this country.

P. S. SARMA.

Recent Research on Vitamins. (*British Medical Bulletin*, Vol. 12, No. 1.) (The Medical Department, The British Council, 65, Davies Street, London, W. 1), 1956. Pp. 90. Price 15 sh.

This brochure published as a memorial to the late Sir Edward Mellanby, will be welcomed by many scientists in India, particularly because they had the opportunity of meeting him and knowing him during the period he was in this country as the first Director of the Central Drug Research Institute at Lucknow. The introduction written by Sir Rodolph Peters and an appreciation of Mellanby by Sir Charles Harington precede the seventeen articles written on different vitamins by several English authors. The articles are more in the nature of reviews, giving the latest position of that subject and the possible future lines of development in that particular field.

Special mention may perhaps be made of the article on 'Vitamins and the Protection of the Liver' in which C. H. Best, C. C. Lucas and J. H. Riddoubt discuss in detail the role of active methionine and other lipotropic factors. L. J. Witts has reported in another article the recent work on B vitamins in the blood and gastro-intestinal tract, especially in relation to human diseases. There are two articles by H. M. Sinclair in regard to the relationship

which exists between vitamins and the nervous system, and vitamins and skin. R. A. Morton and T. W. Goodwin have reviewed the present position in regard to carotenoids and vitamin A, while Thomas Moore has reviewed the present status of our knowledge in regard to vitamin E. Among other articles of interest are one on vitamin B<sub>12</sub> by Lester Smith, another on vitamin C by L. J. Harris and a third by C. E. Dalglish on the interrelationships of tryptophan, nicotinic acid and other B vitamins, while the last three articles are on (i) anti-vitamins, antimetabolites and chemotherapy, by A. Albert, (ii) effect of processing on the vitamin content of foods, by L. W. Mapson, and (iii) vitamins in nutrition, orientation and perspectives, by B. S. Platt.

All the articles may be considered to be satisfactory in so far as they relate to the nutritional and medical aspects of any particular vitamin, but they are not as comprehensive as the title 'Recent Research on Vitamins' would lead one to believe. However, the objective was limited, in that the articles were chosen to reflect in a general sort of way the broad vision and the wide scientific activities of the late Sir Edward Mellanby. While not claiming to be very exhaustive, therefore, this booklet written in a very lucid style will still appeal to all interested in the medical and nutritional aspects of recent research on vitamins.

P. S. SARMA.

**Bird Navigation.** By G. V. T. Matthews. (Cambridge University Press), 1955. Pp. vi + 140. Price 12 sh. 6 d.

This monograph, in the Cambridge Experimental Biology Series, deals with one aspect of bird migration, the power of birds to find their way across unknown country. It is not merely an account of Dr. Matthews' experimental work in this direction, though that by itself is quite considerable, but a concise and critical summary of all scientific investigation so far in the study of bird navigation. Undoubtedly such work has added appreciably to our knowledge of the mystery of animal conquests of space and direction, but the clumsy words "knowledge of the mystery" are still necessary in view of the fact that even today we lack any complete and convincing explanation of the phenomenon. Dr. Matthews' ex-

periments with Manx Shearwaters and homing pigeons, and the summaries of the experimental releases of over 30 species of wild birds over short and long distances, make fascinating reading.

M. KRISHNAN.

**Mass Spectrometer Researches.** By G. P. Barnard. (Published by Her Majesty's Stationery Office, London, for D.S.I.R.), 1956. Pp. iii + 62. Price by post 3 sh. 9½ d.

The monograph describes the special features of an experimental sector-field mass spectrometer that was constructed at the National Physical Laboratory, England, and some of the experimental researches undertaken with this instrument. Various ion source designs of the electron bombardment type were examined with the aim of gaining a better understanding of the role of the magnetic field in the source region.

The researches described include work on the integrated effect of the fringing flux in sector-field instruments; on ion sensitivity and gas concentration with pseudo-molecular-beam arrangements; and on studies of voltage co-efficients, peak shapes and ion transmission efficiencies for various source arrangements. The relationship between source magnetic field strength and mass resolution is also examined.

#### Books Received

**The Chemistry of Tanning Processes.** By K. H. Gustavson. (Academic Press), 1956. Pp. ix + 403. Price \$9.00.

**Frequency Response.** Edited by Rufus Oldenburger. (Macmillan Company), 1956. Pp. xii + 372. Price \$7.50.

**Methods of Biochemical Analysis, Vol. III.** Edited by David Glick. (Interscience), 1956. Pp. x + 437. Price \$9.50.

**Antibiotics Annual 1955-56.** Edited by Henry Welch and Felia Marti-Ibanez. (Interscience), 1956. Pp. xvii + 994. Price \$10.00.

**Carnegie Institute of Washington Year-Book, No. 54, 1954-55.** (Carnegie Institution of Washington, Washington 5 D.C.), 1955. Pp. xxxix + 311. Price \$1.00.

**Technique of Organic Chemistry, Vol. IX. (Chemical Applications of Spectroscopy.)** Edited by W. West. (Interscience), 1956. Pp. xxiv + 787. Price \$15.00.

## SCIENCE NOTES AND NEWS

### Occurrence of *Corchorus aestuans* L. (= *Corchorus acutangulus* Lamk.)

Shri R. M. Datta, Department of Agriculture, Calcutta University, states that he observed *C. aestuans* (= *C. acutangulus*) occurring sparsely at an altitude of 2,200' in West Kurasia Hill (Vindhya Range) near Chirmiri in M.P. in November 1955. The plants were very stunted, and smaller than the Bengal specimens. This might probably be due to the altitude, but the sizes of the flowers and fruits were not altered. This is the first report from Madhya Pradesh.

### Cosmic Ray Activity, 22 Feb. 1956

The greatest burst of cosmic ray intensity ever recorded began at 9-45 p.m., 22 February, according to observations in the Chicago University. The event is described as the most outstanding example so far detected of the sun's production of cosmic ray particles. Onset of the outburst was recorded automatically at the University of Chicago's Enrico Fermi Institute for Nuclear studies. Balloons carrying apparatus to detect and report the cosmic ray outbursts were launched the following day. Such airborne apparatus is the first ever to be aloft during a cosmic outburst of the present intensity.

### Magnetic Refrigerator

A new type of cryostat that will maintain lower temperatures than any previous apparatus has been developed at Arthur D. Little, Inc., Cambridge, Mass. The design represents a major departure from ordinary refrigerating systems. It is based on a cyclic principle of magnetic cooling originated by Drs. John G. Daunt and Clifford V. Heer of the Ohio State University.

There are no moving parts or flowing fluids in this cooling system. It uses, instead, a plastic capsule 3" long, containing a special chemical salt as the refrigerant. Operation of the cryostat is controlled entirely by external magnetic fields.

The principle of magnetic cooling has been used for several years in a few cryogenic laboratories for achieving extremely low temperatures in the range of absolute zero. This is the first apparatus, however, that has been

able both to produce these extreme low temperatures and to maintain them for long periods of time. All previous equipment would immediately begin to warm up as soon as the low temperature had been reached.

### Multi-Purpose Food

A multi-purpose food has been evolved at the Central Food Technological Research Institute, Mysore. The product is similar in nutritive value and appearance to the multi-purpose food developed in America and is cheap, two ounces costing one-and-a-quarter anna only. The food is composed of a mixture of specially processed low fat groundnut flour and roasted Bengal gram flour, fortified with calcium salts, vitamins A and D, thiamine and riboflavin. It is available in two forms, seasoned (with salt and spices) for use in soups and savoury preparations and unseasoned for use in porridge, puddings and sweet preparations. The composition of the product per 100 g. is: protein, 41.9 g.; calcium, product per 100 g. is: protein, 41.9 g.; calcium, 0.665 g.; phosphorus, 0.820 g.; iron, 5.13 mg.; vitamin A, 3,000 I.U.; vitamin D, 250 I.U. and nicotinic acid, 14 mg.

Extensive consumer acceptability trials have shown that the product can be incorporated at levels ranging from 25-50% in various common food preparations based on cereals, without affecting their taste and acceptability.

### Shrimp Ground along Indian West Coast

A vast shrimp ground stretching more than 140 miles along the Malabar Coast, India, has been discovered by Mr. G. S. Illugason, an Icelandic master fisherman employed by the Food and Agriculture Organization (F.A.O.), on a fisheries mission to Madras State. Supplies are available in about a 4-mile wide strip stretching at least 140 miles from Beypore north to Mangalore. The shrimp average about 4-5" in length and are being caught by a small shrimp trawl, towed by a 10 H.P. open boat, at a rate of 100 lb. an hour.

The commercial and economic consequences of the discovery will be most favourable for the fishermen, who can now catch ten times as much during the mid-winter and spring and increase their earnings accordingly—if they have mechanized boats.

**Radioactive Yttrium in the Treatment of Cancer**

Radioactive yttrium is the latest peaceful product of atomic energy to be used in fighting cancer. It is incorporated into a phase which is formed into a fine, flexible thread. The thread is then placed in diseased tissues where the radiations from the yttrium can have a curative effect. The plastic into which the yttrium is incorporated slowly dissolves in the tissues, leaving the source of radioactivity in the tissues to be treated. Yttrium is particularly easy to place in certain tissues, because it is not carried from place to place by body processes.

**NSF Institutes for Science and Mathematics Teachers**

The National Science Foundation, U.S.A., will continue its programme of summer institutes for high school and college teachers. In addition, the foundation will support two experimental academic year institutes designed to assist colleges and universities in their efforts to improve science subject-matter training programmes for high school teachers of science and mathematics. Both programmes are directed towards strengthening the capacity of teachers to motivate students to consider careers in science and engineering by increasing the students' comprehension of basic science and mathematics. Now in its fourth consecutive year, the programme will provide opportunities for staff members of colleges and high schools to attend courses in the subject-matter of science and mathematics that are especially designed for teachers and that are conducted by faculty members noted for competence in their fields and for skill in presentation.

**Dr. Sampurnanand Prize**

Dr. Sampurnanand, Chief Minister of Uttar Pradesh, has placed at the disposal of the National Academy of Sciences, India, a sum of Rs. 1,000 to be awarded as a prize to any Indian scientist who makes a contribution to our knowledge of Space Travel and its technique—physical, chemical, mathematical, psychological and physiological. The papers should be typewritten with double spacing on one side of foolscap paper and should not be more than 100 pages in length. Four copies of the paper should be submitted, of which only one copy should contain the name and address of the author on the title page. They should reach

the General Secretary, National Academy of Sciences, India, Lajpatrai Road, Allahabad-2, on or before 15th October 1956.

**The Correct Name of *Hemicyclia travancorica* Bourd**

Sri. S. K. Jain, Herbarium, National Botanic Gardens, Lucknow, states that Pax and Hoffmann (1922) reduced *Hemicyclia* to a section of the genus *Drypetes* Vahl, and transferred all species of the former to the latter genus, except *Hemicyclia travancorica* Bourd. This species is a good *Drypetes*. The correct name of this therefore will be *Drypetes travancorica* (Bourdillon) Jain, *Comb. nov.*

**Raptakos Fellowships for Medical Research**

The Raptakos Medical Research Board will consider applications for the award of fellowships for research work on medical and allied subjects in recognized institutions situated in the Union of India. The awards normally consist of Rs. 3,000 per year for a Fellowship and Rs. 750 per year towards special equipments or chemicals approved by the Board.

Applications in the prescribed form (which may be obtained from the Secretary and Treasurer, Raptakos Medical Research Board, Dr. Annie Besant Road, Worli, Bombay-18), should be submitted before September 30, 1956, for grants commencing from January 1, 1957.

**Birbal Sahni Institute of Palaeobotany**

The Committee of Directors of the International Union of Biological Sciences have appointed Dr. D. C. Bharadwaj, Reader in the above Institute, as a member of the International Committee on Palynology (C.I.P.), Paris, France.

**Zoological Society of India**

The Zoological Society of India has decided to publish small brochures of popular interest on zoological topics. Persons desirous of contributing articles in this scheme are requested to correspond with Professor M. B. Lal, Honorary Secretary, Zoological Society of India, C/o. Department of Zoology, The University, Lucknow.

**Award of Research Degree**

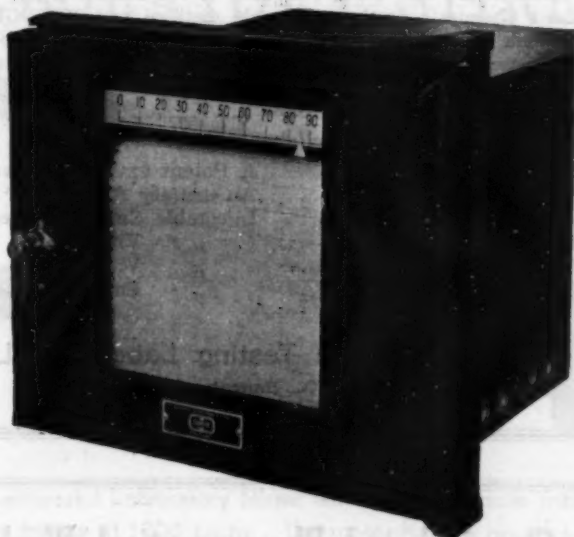
The University of Poona has awarded the Ph.D. Degree in Physics to Shri Ananta Krishna Ramdas for his thesis entitled "Crystal Optics in Relation to Crystal Structure".



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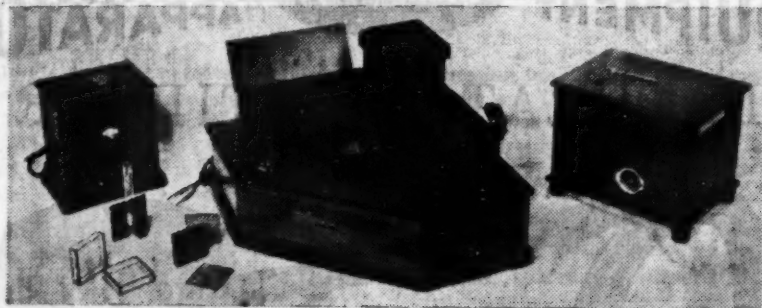
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